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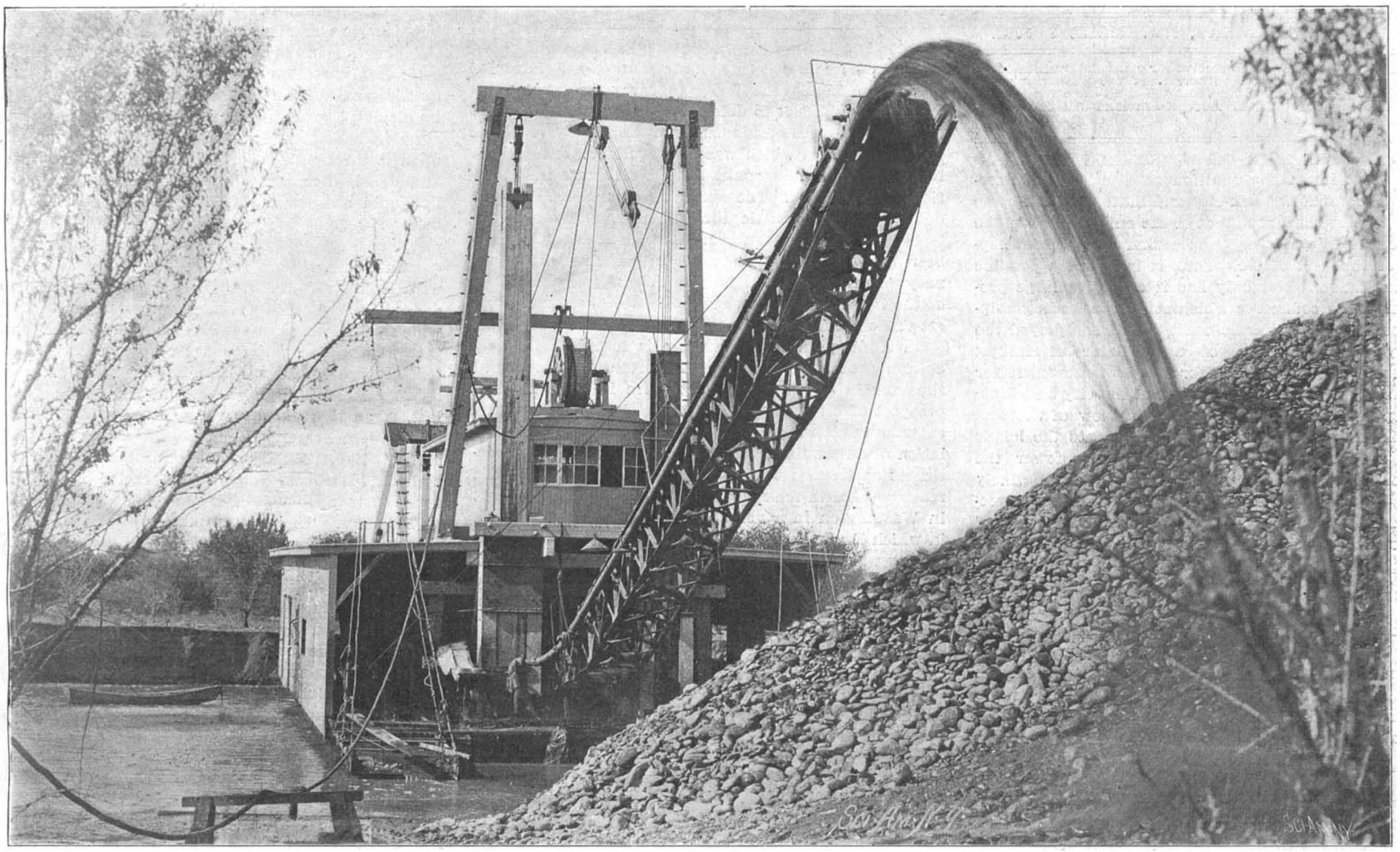
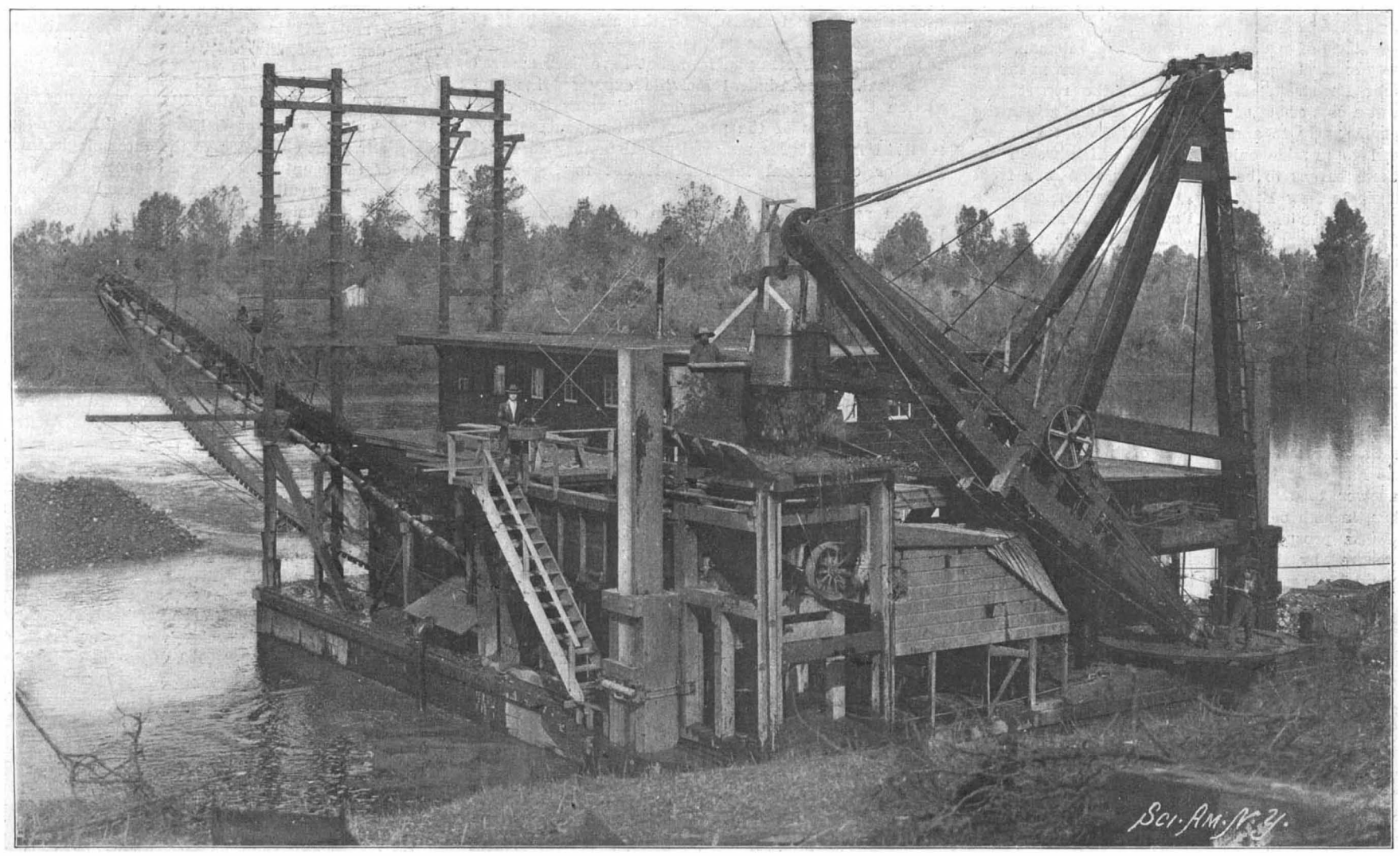



THE DREDGER "INDIANA" PROVIDED WITH A CONVEYOR AND AN AUXILIARY SAND PUMP.




**A CALIFORNIA SINGLE BUCKET GOLD DREDGER.**—[See page 311.]

By means of this machine the bottom of the river is dug up and delivered into a sluice whence the sand is separated and washed on gold-saving tables and the waste material is conveyed away by an endless carrier.

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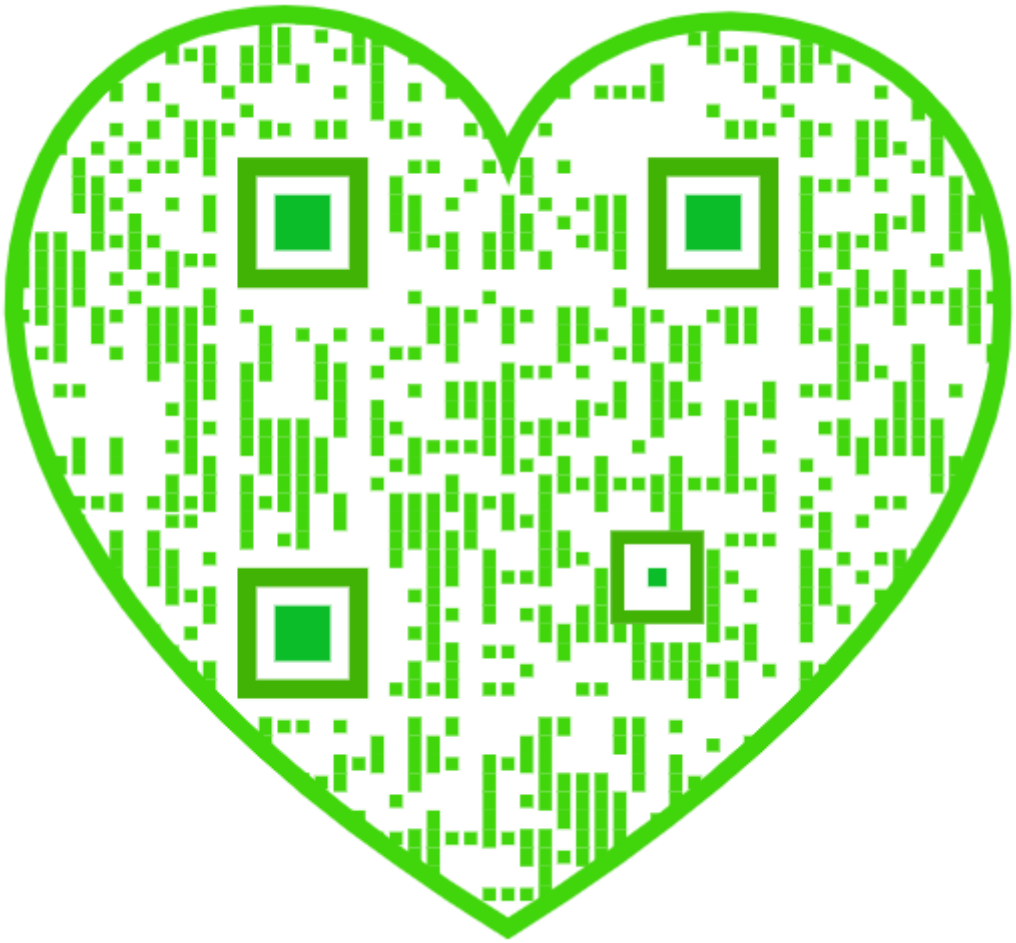

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NEW YORK, SATURDAY, NOVEMBER 8, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.


## THE ERIE CANAL QUESTION.

The most important question affecting the commercial welfare of New York city and State that will come before the Legislature is that of the enlargement of the Erie Canal—a waterway whose share in the development of the port of New York it is scarcely possible to overestimate. Not only has it carried a large proportion of the commerce which seeks the leading shipping point of the Atlantic coast, but it has played the equally important part of a regulator of freight charges by the railroads. For this last reason, if for no other, it will be to the interest of the city and State to keep the canal open, especially in view of the fact that the railroads are steadily passing into the hands of a small number of individuals. The fewer the number of owners of our railroads, the more likely they will be to get together in some form of agreement for the abolishing of competition, and in view of this contingency it is well to remember that the canal through this State must ever remain the constant regulator of freight charges.

The present situation renders necessary an immediate decision, either to abandon the canal altogether or to bring it up to a point where it can meet the modern conditions of traffic. The great improvements which have been made in recent years, both in the track and rolling stock of the railways, have resulted not only in a vastly increased capacity, but in a reduced expense of haulage, and have rendered the canal in its present condition so much out of date that it has lost, or is rapidly losing, its influence as a regulator of freight. Moreover, in order to bring the canal up to a standard at which it can compete successfully with the railroads, it will not suffice to enter upon the reconstruction in any half-hearted and parsimonious spirit. The question of the extent of reconstruction necessary was carefully gone into during President Roosevelt's term of office as Governor of this State, and the findings were expressed in a report by the committee of which Gen. Greene was chairman. The scheme proposed received the hearty indorsement of Governor Roosevelt. Briefly stated, the report proposed, at a cost of $60,000,000, to deepen and widen the canal sufficiently to admit barges of 1,000 tons capacity and to provide enlarged locks which would enable these barges to be towed in fleets of four from the Lakes to New York city. This would necessitate a uniform depth of 12 feet throughout, and to every student of the canal question it is evident that this is the smallest practicable depth on which the canal could be brought up to modern requirements. That nothing less than this will meet the case is further evident when we remember that the great canal improvement which was completed three or four years ago on the St. Lawrence River gives the Canadian territory a system of canals which provides a minimum depth of water of 14 feet from the Great Lakes to the Atlantic. A determined effort is being made to divert to the St. Lawrence route much of the wheat which hitherto has come to the port of New York, and the best answer to the Canadian canals would be the carrying through of the proposed $60,000,000 improvement. The prospects of favorable canal legislation are improved by the increasing and more intelligent interest which is manifest in the canal in the rural districts, which hitherto have been either lukewarm or strongly opposed to the whole scheme. With public attention aroused throughout the State, the prospects of successful canal legislation were never brighter. To New York city itself the canal is of most vital importance, for the reason that we are gradually losing our relative standing among the great grain ports of the Atlantic coast, because of the differential charge which the railways make against the port of New York. This is an extra charge on freight which is made on account of the easiness of access for western freight to this city as compared with the difficulties in the way of mountain ranges and heavier grades which are encountered by freight that is taken to other Atlantic ports. Not only have we the easiest approaches by rail, due to the absence of mountain grades; but New York possesses the finest harbor, is the terminal port of the speediest and largest steamers, is the great center of capital, and has all the advantages which accrue to a great metropolitan city. Hence the railroads which terminate at other ports have demanded that there shall be a higher charge on freight to New York to offset these natural advantages. This being so, it is evident that if we are to maintain the equilibrium on our side, we must see to it that these natural advantages, among which the Erie Canal is one of the greatest, be maintained in the very highest state of efficiency. Whatever may be said about the justice or injustice of differential rates, it is certain that the argument for the canal based upon them is unanswerable.

## LIQUID FUEL FOR NAVAL PURPOSES

Congress at its last session made an appropriation of $20,000 to enable the Navy to carry out exhaustive trials of liquid fuel to determine its suitability for use on naval vessels. This sum, in addition to several thousand dollars which was also available, enabled the Navy Department to make a most elaborate investigation of the subject. The work was planned and carried out with characteristic thoroughness, and while the tests have not yet been completed, sufficient data have been gathered to enable the Board to make a preliminary report which will be found in the current issue of the SUPPLEMENT, that cannot fail to be of the greatest value to marine engineers throughout the world.

On reading this document one is forced to the conclusion (and this is the most important fact developed thus far in the inquiry) that there is no immediate prospect of oil fuel being immediately adopted to any extent on battleships and cruisers, although the installation of oil-burning furnaces is regarded as quite practicable on torpedo boats and, indeed, its installation is recommended in the report. The tests were carried out in Washington in a very complete experimental plant in which Beaumont oil, slightly refined and of uniform quality was used. In his review of the report submitted to the Secretary of the Navy, Rear-Admiral Melville observes that any fuel which will get rid of smoke, reduce the fireroom staff, extend the steaming radius, and assist in the realization of maximum speed at short notice, will add to the efficiency of warships. Referring to the experiments made by various naval powers with the use of oil, he points out that failure has resulted from the mistaken attempt to burn oil in the same manner as coal. It is now well understood that the oil must be atomized at the burner, since it is impossible to completely turn it into gas before ignition, and that to secure its full value in the boiler, the length of furnace, volume of the combustion chambers, and calorimetric area are factors which must be carefully considered. The experiments conducted by the Liquid Fuel Board have proved that it is possible to force the combustion of oil, and that in an oil fuel installation, where provision has been made for atomizing the fuel and heating the air and oil, it is possible to greatly exceed the highest evaporation per square foot of heating surface that have been secured with coal. Rear-Admiral Melville expresses his conviction that by further experimental work the engineering features of the problem will undoubtedly be resolved in a degree materially satisfactory to maritime or commercial interests, if not to the naval experts.

With regard to its installation on battleships and large cruisers, where the fuel would have to be stored in the double bottom, it is considered that the proximity of such a large amount of electric wiring as is found on a modern warship, to the oil tanks, which would necessarily throw off a considerable amount of vapor, might cause an explosion and set the fuel on fire, and it is pertinently suggested that the limited experience of the Navy with submarine boats may provide a lesson as to the liability of hydrocarbon gases to explode. In concluding his review of the report, Admiral Melville affirms that he has no hesitation in declaring that, in view of the results already secured with these tests, an installation should be placed at once on at least one-third of the torpedo boats and destroyers, where there would be an opportunity for further systematic study of the subject. With regard to merchant vessels, where the structural disadvantages under which warships labor are not present, it is believed that oil fuel may be used to advantage, and that the information gathered by the Board will materially increase the installation of oil-fuel plants in the merchant marine.

## A NEW HYDRIDE OF SILICON.

A new hydride of silicon has been lately discovered by Messrs. Henri Moissan and S. Smiles. This body is a gas at ordinary temperature, but by using liquid air the experimenters were able to liquefy and then solidify it. The process is described in a paper read before the Academie des Sciences. The combinations of hydrogen and silicon are few in number and only two are known, one a gas discovered by Buff and Wöhler in 1857, $Si H_4$, and a solid body prepared by Ogier as a yellow deposit by the action of the electric stream upon hydrogen silicide. The gaseous hydrogen silicide was obtained by the former experimenters in decomposing water by the electric current, using aluminium electrodes rich in silica, then by Wöhler in reacting upon silicide of magnesium by hydrochloric acid. It is the latter method which has been followed here, applying the method of fractional separation. The silicide of magnesium is prepared by mixing powdered magnesium such as is used in photography with crystallized silica in fine powder, the proportions corresponding to $Si Mg_2$, and the mixture is calcined at a red heat in a tube through which is passed a current of pure hydrogen. Thus a friable and bluish mass is obtained, which is an impure silicide of magnesium, but does not seem to be a definite compound. When the bluish mass is acted upon by dilute hydrochloric acid, it gives off a gas containing hydrogen silicide, that is spontaneously inflammable. The gas is prepared by placing 5 grammes of the impure silicide of magnesium in a flask and pouring dilute hydrochloric acid upon it through a tube. The gas given off is washed and dried, then passed in a U-tube which is cooled by liquid oxygen or liquid air. The tube has a bulb below for receiving the condensed liquid. At a temperature of 80 degs., obtained by acetone and solid carbonic acid, only a trace of liquid is condensed, but with liquid air at 180 to 200 degs., the gas is condensed in the solid form and the remainder of the gas which passes through ceases to be inflammable on contact with air. This solid body becomes liquid as the temperature rises, and soon begins to boil, giving off hydrogen silicide gas, which may be collected. At last, when the tube has reached the ordinary temperature there remains a liquid whose properties have been studied. The experimenters obtain thus a liquid hydride of silicon, which when cooled in liquid air, crystallizes upon solidifying, and these crystals melt at 138 degs. The most remarkable property of this new compound is that it takes fire spontaneously in air at the ordinary temperature; it burns with explosion, producing a white and brilliant flame and giving a deposit of amorphous silicon and also silica. Its density is greater than unity, for when placed in water it falls to the bottom of the vessel and dissolves slightly. It takes fire spontaneously in chlorine gas, and at the ordinary temperature the reaction is violent. If a small quantity is vaporized in an atmosphere of hydrogen, the gas becomes spontaneously inflammable in air, while ordinary silicide of hydrogen has not this property. The analysis of this body was difficult on account of its inflammability, but the experimenters collected it in bulbs which were broken in a test-tube full of mercury and the liquid could thus be acted upon by an alkaline solution, when the hydrogen given off was measured and the silica of the alkaline silicate estimated. The reaction is as follows:

$$Si_2 H_6 + 4Na OH + 2H_2O = 2 (Na_2 Si O_3) + 7H_2.$$

The formula $Si_2 H_6$ is given from analogy with ethane, and this is to be verified by obtaining the vapor density of this body.

## FRUIT PARASITES AND THEIR DESTRUCTION.

The fruit growers of California willingly acknowledge their great obligation to the entomological department of their university for the success with which the ravages of fruit pests in that State have been diminished if not totally prevented. To the scientific investigations of the faculty of that institution is due the general immunity from severe financial loss which the orchardists of the State enjoy.

No class or variety of fruit, the cultivation of which has been attempted in California, ever reached the period of successful propagation than some new species of destructive insect pest instantly appeared to prevent it. This fact is true in all localities. The orange, for instance, could not have been successfully raised in California, but for the introduction of the Australian lady bug, which feeds upon the orange scale. The plum, peach, apricot, apple, and in fact every other fruit known to the coast, each developed a natural enemy which would have destroyed it but for the successful efforts of the university entomologists in combating it. In some portions of the State, notably in Placer County, a new specimen of moth developed which proved so destructive that a loss of fifty to sixty per cent in the peach crop was suffered. Around Newcastle the direct financial loss in the peach crop alone is estimated at $1,373,000 in the past four years.

The University of California was appealed to, and Warren T. Clarke, assistant entomologist, was sent to investigate. He was successful in his search, and returned with complete data of the habits and life history of the worm and methods of propagation. Prof. Clarke, in order to learn the characteristics of the new species of insect which was doing such immense damage, fastened twigs, in which the eggs were embedded, to his underclothing and thus hatched them out.

From the knowledge thus gained, Prof. Clarke was

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enabled to devise a means for the extermination of the destructive pest. The loss of fruit was reduced in the current year to a maximum of one and one-half per cent.

### RECOVERY OF WASTE IN USING WHITE METALS.

A very valuable paper by Joseph Richards, ex-president of the Franklin Institute, upon utilizing the waste entailed in working silver, tin, zinc, antimony, bismuth, lead, mercury, and their alloys is here reduced to its lowest terms for the benefit of manufacturers employing such metals in their goods. The author says that it is more than forty years since he began his investigations in the direction indicated, and his experience is therefore of practical value.

I found, says the author, that tin and galvanized iron scrap could be utilized by removing the coatings, the average tin amounting to 3 per cent; the resulting iron plate could be re-puddled, and the scheme was so promising that I resolved to erect a plant upon a commercial scale. Six lager beer casks, about 6 feet by 6 feet, were set in the ground in a semicircle and a crane rigged that commanded all of them. In the first tank hydrochloric acid was placed, in the second water, and water with a little lime in the third. In the fourth cask was water again, and in the fifth a solution of copper sulphate. A wooden cage containing about 200 pounds of clippings put in loosely was turned into No. 1 tank, and raised after ten minutes' immersion to observe the result. If the tin had been dissolved the cleaned scrap was put in the tank containing water alone, and agitated thoroughly and then put into lime tank No. 3, which neutralized all the acid remaining in the pores of the iron; afterward washed again in tank No. 4, and finally plunged into the copper sulphate for a moment to prevent the scrap from rusting when exposed to the air, which would almost instantly attack it. The iron scrap was then worked into balls under a press and was worth from $10 to $12 per ton. After the process described had been continued for some time the acid would be neutralized in No. 1 tank and would contain tin chloride in solution. The tin-scrap cleaning was here discontinued for a time, for another stage of the recovery. Galvanized iron scrap was put into the cage and immersed in tank No. 1; when it came in contact with the tin solution the metallic zinc took the place of the tin, forming zinc chloride, all the tin being precipitated as metallic tin, in a finely divided state. From about 10 tons of scrap I got about 600 pounds of tin; the zinc chloride sold for $20 per barrel for disinfecting purposes, and for treating wood to make it fireproof. Although commercially successful, the process had to be discontinued, on account of the objectionable vapors created which annoyed the public.

The galvanizing bath is of various sizes, according to the work to be done, and divided on the surface by a partition into two parts. On one side a flux is placed which will dissolve the oxide of zinc on the surface or prevent its formation.

The flux used is ammonium chloride (salammoniac), and the other side of the bath is kept clean by constantly skimming the oxide of zinc as fast as it forms. Just here is where loss occurs, for considerable shot-zinc is formed and removed with the oxide. Also, the salammoniac side soon becomes covered with a thick black crust, or scum, consisting of the dissolved oxide which has partly decomposed the ammonium chloride and formed a double chloride of zinc and ammonium. Salammoniac must be fed constantly to the top of the pot so as to keep the surface of the molten zinc clean and free from oxide, or else the oxide will adhere to the iron surface and seriously injure the finished product by leaving spots on it not coated with zinc. After a time the crust gets so thick on the top that the plates cannot be pushed through it, and a portion must be removed. This causes waste on one side of salammoniac and on the other of zinc.

Another by-product made is zinc-slab dross, formed by washing away a portion of the iron being galvanized, for molten zinc alloys with iron, and as soon as it becomes hot as the bath, begins to dissolve in the zinc. This addition of iron to the bath forms an alloy of iron-zinc which is heavier than the zinc and falls to the bottom; a bath of the usual size for sheets will collect a ton in one week. It is removed by a perforated spoon to allow the zinc to run out and the dross is pasted into molds and forms the slab-dross of commerce. There are then, in galvanizing, three by-products, salammoniac skimmings, slab-dross, and zinc oxide. The skimmings can be recovered by leaching the skimmings in hot water and steam, which gives all the zinc chloride and ammonium chloride in solution, which last can be evaporated down and recrystallized for use in the bath again. The residue contains zinc oxide, dirt, and shot-zinc; this last on being put into a tumbling barrel ground out all the oxide and cleaned the zinc finely, so that it was worth $30 per ton to makers of zinc paint.

The average yield was: zinc 20 per cent, zinc oxide 35 per cent, ammonium and zinc chloride 30 per cent, iron scale and dirt 15 per cent. I then visited galvanizing works and bought all the waste skimmings, etc., I could get and it realized about $300 a carload. The largest lot I ever treated realized when melted and refined 25,000 pounds of good spelter. The oxide process is now generally used in the trade, having been purchased from my workmen by other parties. Galvanizers now separate their skimmings, and it is worth about $40 per ton, according to quality.

The most valuable by-product in galvanizing is the zinc-dross, and I made numerous costly experiments before I had any success at all. Cyanides answered the purpose of recovery well, but were too costly. I finally patented a process which dispensed with the direct use of cyanide and solved the problem of recovering the zinc from the dross, so that it is almost equal to virgin spelter by analysis.

The sensitiveness, so to call it, of zinc to any addition of aluminium is well shown by the fact that 1-1000th part of the latter is immediately detected, and the quantity, although so small, is taken up at once and distributed. It is of no advantage to exceed the quantity mentioned. If a quantity of pure zinc be poured into a mold it will not run half way down, but if a portion only of aluminium alloy be put into the ladle, the effect is to make it as fluid as water. For practical purposes I use 2 per cent aluminium and 98 per cent of zinc, and over 100,000,000 pounds of zinc dross have been treated by this process. Scrap zinc is melted in pots and treated in the same way as the zinc dross for impurities, and battery zincs which contain mercury are treated in a special way which recovers all the mercury. Britannia metal, pewter and scrap pewter are often plated with silver, which must be stripped off before treating them. This is done by the usual processes well known to the trade, and not calling for special mention. The metal is then made into ingots and sold for typefounding, stereotyping, and Babbitt metal. The composition being changed, according to the metal to be made at any time by adding tin or copper, etc.

### BAROMETER READINGS.

BY ROBERT GRIMSHAW.

We often hear: "It is going to rain soon; the barometer stands at 'stormy.'" It is high time that barometer-makers stopped putting their instruments on the same level as the frog-in-a-bottle affairs, by marking them "Clear," "Very dry" and so on. Properly understood and used, the barometer is a reliable instrument, not only for measuring the weight or pressure of the air, but also in connection with the weather-cock and the thermometer, for prophesying weather conditions in the near future.

What a good barometer does tell is the weight of a column of air of definite cross section, reaching upward from the level of the instrument to the surface of the aerial ocean which surrounds our earth. But no matter what the condition of the weather, this weight varies with the depth from the surface of the aforesaid ocean, so that if the column stands at 762 millimeters at the level of the water-ocean which lies at the bottom of the aerial one, the same instrument would stand at a height of 1,178 meters above the sea level at only 663 millimeters. This being the fact, a barometer that at the sea-level stood at "Very dry," would, under the same conditions of temperature of the air and of the instrument itself, indicate "Stormy" when carried to a height of 1,178 meters above the sea.

The "prophecies" of the mercury barometer are different for various temperatures and degrees of moisture of the air in any one country, and for different countries. Further, the "weather indications" of an aneroid and of a mercurial barometer for the same readings are different; because a good aneroid is not influenced by the air-temperature.

Those who use the mercury barometer scientifically and for scientific purposes, use tables giving the following data:

(1) Height of the column of mercury for each distance above sea-level; (2) "corrections" for the height, for different latitudes; (3) logarithmic corrections for temperature and latitude; (4) the height of a column of air corresponding to each difference of one millimeter or of one special fraction of an inch, in the height of the mercury column; (5) "corrections" for the height of the mercury for different barometer temperatures, at different heights above the sea, and which latter corrections must be applied, before the height of the mercury column can be used with the other tables; (6) the average temperature of the air at the sea level for each month for the district where the observation is made.

It may be noted here (a) that the differences of temperature during the day vary with the latitude; (b) the higher the latitude, the greater this variation; (c) the average temperature for the twenty-four consecutive hours in the day is that of 9 A.M., and (d) the average daily temperature between 9 A.M. and 5 P.M. occurs at noon.

### SCIENCE NOTES.

For the last three years it has been planned to study the sea and the fisheries of northwest Europe. Two international conferences have been held, and a third convention is now meeting at Copenhagen, where delegates from the governments of the United Kingdom, Germany, Holland, Denmark, Norway, Sweden, Russia and Finland are discussing the problem. It has been decided that simultaneous observations are to be made four times a year. The British government has assigned two ships to the task of making periodical trips in the Faroe-Shetland channel and across the northern end of the North Sea. Trips will also be made in the western part of the British channel. Dutch ships will scour the southern half of the North Sea, while the northern half will be covered by the Germans. Denmark will investigate the region between Faroe and Iceland. Norway will explore the North Atlantic along the extensive western seaboard of Scandinavia. Work has been assigned to Russia along the Murman coast and across Barents Sea to Novaya Zemlya. The Baltic will be studied in detail by Danish, Swedish, Finnish, Russian and German ships. Much scientific, as well as practical, information will be gathered.

Prof. Baccelli's method for the treatment of tetanus has been used during the last few years in a considerable number of cases, especially in Italy. This method consists essentially in administering a series of hypodermic injections of phenol in dilute solution. The phenol is rapidly absorbed, and its action is that of fixing the state of the malady; in the favorable cases no new symptoms appear after the first injections of phenol have been regularly made. As to the symptoms which already exist, these are not at once attenuated, but at the end of several days they diminish gradually. Dr. Croffi has been engaged in formulating the results of the cases treated by the Baccelli method, of which 80 have already been published, and shows that it has given more satisfactory results than the other methods. The figures show a mortality of 12 to 13 per cent, while in the case of anti-tetanic serum as used by Holesti, Haberlinge and others the mortality reaches 30 per cent, which is a considerable difference. Even considering the grave cases, the method is still superior, and shows a mortality of 30 per cent, but this is not excessive, as in the treatment of grave cases of diphtheria by the anti-diphtheritic serum the mortality reaches 37 per cent. The advantages of the Baccelli method are best seen when it is applied from the commencement of the disease, in this case, if the patients arrive at the seventh or eighth day, the issue is almost sure to be favorable. It is a striking fact that while the method is successful in the case of the human system, it seems to have no marked effect upon the animals which have been used in the experiments, but this may be explained by the fact that in the latter case the tetanus shows itself in the acute form which causes a rapid mortality, and here the remedy is of no avail.

An extended series of observations upon the hygiene of acetylene lighting has been recently carried out by M. Masi, a prominent Italian scientist, who made a number of experiments at Rome. The number of appliances for producing acetylene is considerable, but in many cases their imperfections and defective construction have rendered the use of acetylene less extensive than might be, seeing that it has many advantages and is a more healthful method of lighting. According to the experiments of Grehant, Weyl and Frank, the gas has a harmful influence only upon the air when it reaches the proportion of 46 per cent and it is only at 79 per cent that it causes death. When absorbed by the blood in quantities not exceeding 10 per cent it seems to combine easily with the albuminoid elements. The burner, to give a good light, should work under a pressure equal to 3 or 4 inches of water at least, and be mixed, before burning, with oxygen or an inert gas which permits it to come in contact with a great quantity of air. Messrs. Lewes and Hempel have shown that its lighting power is 15 or 20 times that of illuminating gas used in an ordinary burner and from 3 to 5 times when in a Welsbach burner. M. Masi carried out some experiments in a chamber fitted up in the cellars of the Institute of Hygiene at Rome, under the most unfavorable conditions as to ventilation, so as to bring out as much as possible the effect on the respiratory organs. He observed also the intensity and steadiness of the flame, the quality of light produced, the heat and the change brought about in the surrounding air. Repeated experiments on these different points showed that acetylene gave superior results. The gas in burning consumes less oxygen and gives off less carbonic acid gas and water vapor than is the case with other methods of lighting, excluding, of course, the electric light. In a confined locality it produces less heat than either gas, candles or petroleum, and it does not give rise to ammonia, nitrous acid or carbon monoxide. He considers that it does not present any more danger from explosion than gas or petroleum, and that it is cheaper for a given candle power than all other methods of lighting.

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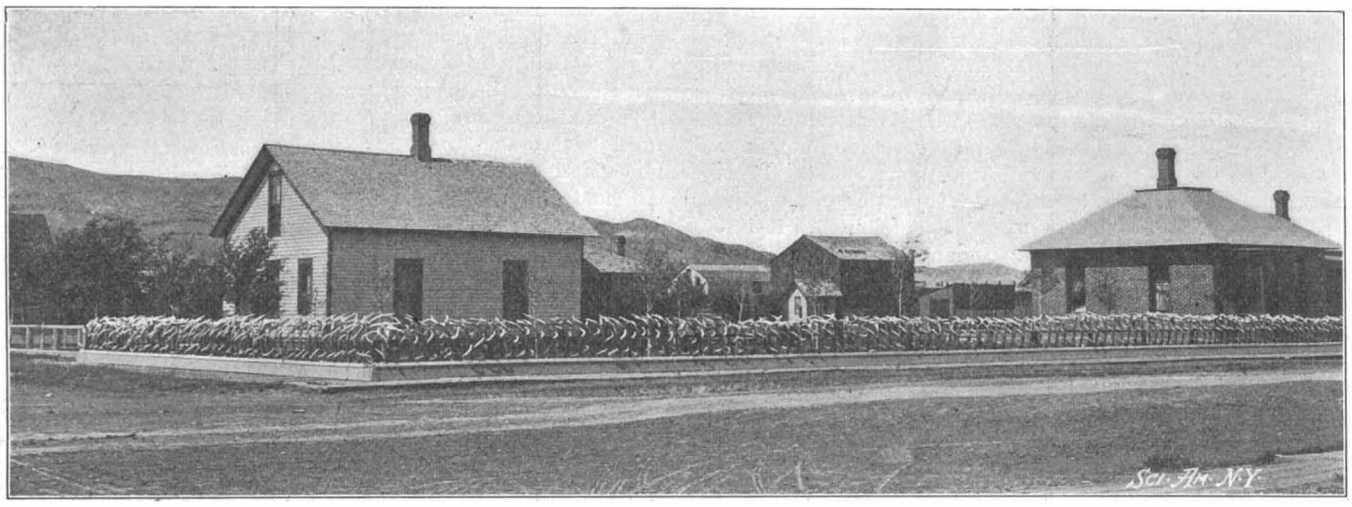
## A CURIOUS USE FOR ELK HORN.

BY CHARLES F. HOLDER.

In past centuries vast herds of elk covered the West. Rapidly they became rarer and rarer. Probably during the present century the animal will become extinct. Up to 1842 it was found in New York State, and later in Pennsylvania, but it has been driven from place to place until many of the regions where it once roamed in vast herds know it no more. So rare is it in California that the two or three small herds are as well located as herds of cattle. Next to the moose the elk is the largest of the deer family, and of all the tribe it is the most commanding and splendid example of big game. Those who have hunted it in Montana, that being at present the best locality, have been amazed to find in certain localities vast numbers of horns, forgetting that the wapiti regularly casts its horns.



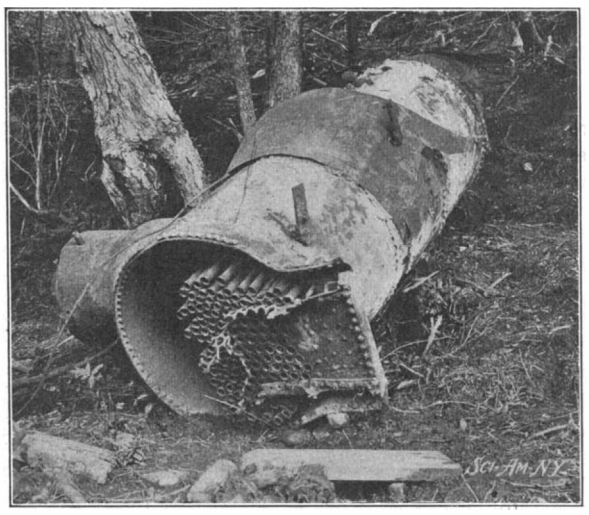
A FENCE MADE OF ELK HORN.

Most of the horns are shed on the winter range; and in the vicinity of the Green River country, Montana, and the adjacent mountains, thousands of such horns can be picked up, or found in all stages of decay, in some places so thick that the observer, not posted as to the actual facts of the case, might assume that there had been a general slaughter. Hundreds of these horns are shipped all over the country as trophies, but in the Montana towns they are used for a much more common purpose. One such is well illustrated in the accompanying photograph, which shows a fence in one of the principal streets of Livingston, Montana, made entirely of hundreds of wapiti horns, dovetailed together so closely that a perfect and ideal fence is the result, one calculated to attract widespread attention. The horns are not taken, as some tourists suppose, from the deer, so representing the destruction of the animal, but have been picked up on the winter range and taken to the town or city for this specific purpose. In the fence shown there are two or three hundred wapiti horns, representing one hundred and fifty animals.

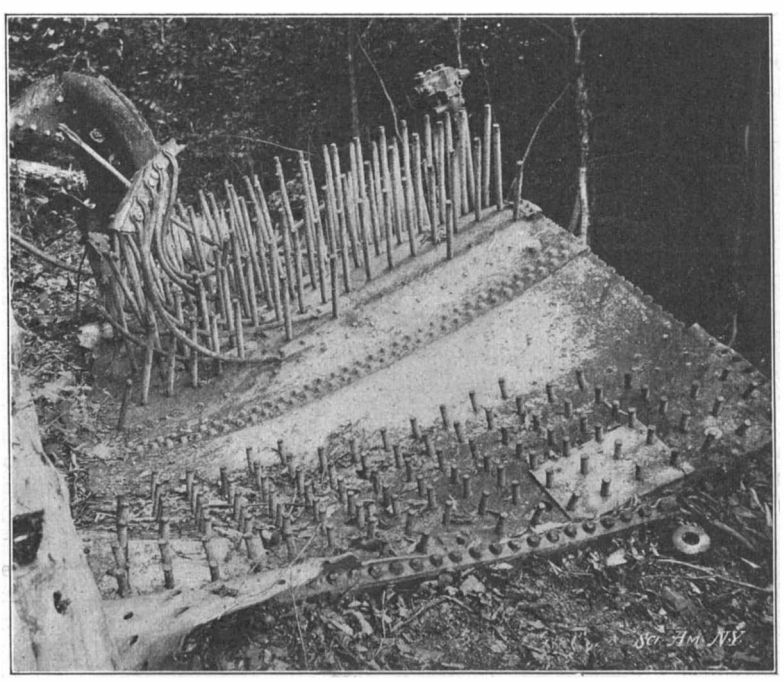
The horns are employed not only for fences, but for chairs, four or five being interwoven and forming a framework to the seat and back. Picture frames are also made from them, and hundreds find their way into manufacturing districts, where they are cut up into large knife handles and used in the manufacture of sporting goods of various kinds. Many are also employed in the decoration of houses. One of the famous hotels of Colorado took its name from the antlers, bearing in its rooms some fine examples of the horns.

## EXPLOSION OF A LOCOMOTIVE BOILER.

By the courtesy of The Locomotive, we are able to present the accompanying cuts showing the explosion of the boiler of a small locomotive, due to the failure of its staybolts. The barrel of the boiler was 48 inches in diameter by 9 feet 8 inches in length. It was built of 7-16-inch plates, with ordinary double-riveted lap joints, the rivet holes being 13-16 inch in diameter, with a pitch of ⅛ inch from center to center. The boiler carried two 2½-inch diameter, pop, safety-valves, which were broken by the explosion and were not afterward found. The crown sheet of the firebox was ⅜ of an inch thick, 78 inches long, and 45 inches wide, and it was secured to the shell by staybolts which were pitched 4½ inches from center to center, while the staybolts on the side sheets were pitched 3½ inches, from center to center. The staybolts in the crown were of 1-inch stock and those in the legs of ⅞-inch stock. At the time of the disaster the locomotive had just drawn a train to the summit of the grade. The explosion was of unusual violence, the engineer and the fireman being instantly killed, the body of the latter being blown literally to fragments. Owing to the death of these two men, the lessons of the explosion can only be gathered from a study of the position and nature of the wreckage. The firebox was torn asunder and flung in all directions, while the barrel of the boiler was shot from the frame with a rocket-like action, traveling upward and forward away from the engine. Its course lay in the general direction of the track; but as the accident took place on the curve, it finally came to rest on the outside of the curve, and about 25 feet from the track. The condition of the ground showed that the barrel struck first on its front end, and then after turning two complete somersaults, striking the ground each time that it turned over, it came to rest 210 feet ahead of the spot where the explosion occurred. One of the largest fragments of the boiler was thrown 110 feet to the right of the track, while another was found 100 feet behind the site of the explosion and 70 feet to the right of the track.



The Barrel, Thrown Forward 210 Feet



A Fragment of the Firebox.

EXPLOSION OF A LOCOMOTIVE BOILER.

While the engravings serve to show the unusual violence of the explosion, there is no conclusive evidence as to the immediate cause of the disaster. At the same time it was noticed that a number of staybolts were broken before the accident, and it is considered probable that the explosion was due to loss of strength from this cause.

### Artificial Indigo.

The first artificial indigo was made by Prof. Adolf V. Bayer, of Munich, in 1879. The material used was orthonitrophenylpropriol acid (an inorganic acid of which nitrogen and phenol are chief elements). The process was acquired by two important German factories, but after a few years of costly experiments, they were forced to cease their efforts, the expense of the materials alone being greater than the selling price of genuine indigo. Then followed twenty years of earnest labor and diligent research to discover practical means of producing artificial indigo. Over 200 patents were taken out. German dye factories spared no time, pains, or expense to solve the problem. The chemical constitution of indigo was fathomed, but the right material with which to make it was not forthcoming.

In many of the experiments, toluol, a coal-tar product allied to benzole, was used. It was an interesting but useless effort, because the available toluol was sufficient to produce only 1,500,000 kilogrammes (3,306,900 pounds) of indigo, while the world's consumption of indigo was estimated at 5,000,000 kilogrammes (11,023,000 pounds).

Finally, Prof. Karl Heumann, of Zurich, made the important discovery that naphthalene could be used as the raw material for artificial indigo. Naphthalene is much employed in the production of colored stuffs and in various other industrial processes, and is declared to be obtainable from coal tar in sufficient quantities to cover the world's consumption of indigo.

Exactly how naphthalene yields a practicable indigo; what chemical operations are utilized; what substances must first be produced in order to obtain the desired article easily, cheaply, and pure in quality—all these facts are withheld from the general public in the interest of the factories which are engaged in costly experiments. It is said that the aniline and soda factory at Ludwigshafen has alone invested 18,000,000 marks ($4,284,000) in equipping and conducting an indigo-making department.

The employment of artificial indigo is spreading. Advantages are claimed for it over the genuine article—for instance, that it is always the same and it is free from objectionable mixtures, and therefore pleasanter to use and purer in its coloring. The sanguine prophecy is added that it is merely a question of time when artificial indigo will be used not only generally, but solely.

### Disappearance of the Terrapin.

The world-famed Chesapeake terrapin is evidently fast disappearing. All along the Chesapeake Bay terrapin hunters are finding greater difficulty than ever in capturing the diamond-backed creatures, so highly prized by gourmets. It seems strange now to read that in ante-bellum days the Maryland legislature once passed a law prohibiting slave-owners from feeding terrapin to their slaves oftener than once a week—a law, the passage of which was prompted by the negro taste for pork.

The preservation of the terrapin supply has been a problem that has given the dealers much concern during the last few years. It is doubtful whether the creature will propagate in captivity. But it is certain that incubators will protect the eggs from the ravages of marsh rats and crows. The chief source of terrapin supply is now Crisfield, Md., although many diamond-backs come from the Choptank River and the waters of Talbot County. At Crisfield the dealers have been in the habit of gathering terrapin and impounding them in the water. The result of this is that all the good Chesapeake terrapin are at Crisfield, imprisoned by dealers. The price now for 7 and 8-inch terrapin is $60 a dozen; for 6 to 7 inches, $36 a dozen; 5 to 6 inches, $14 a dozen; and under 5 inches, $2 a dozen. The discrepancy between $60 and $2 a dozen is due to quality; for the diamond-back increases in flavor with age and appears to become more tender as it grows older. Furthermore, the smaller terrapin cannot be marketed, since the law prohibits it.

Time was when catching terrapin for the market was a prosperous calling along the Bay shore; but with the practice of impounding, the waterman's life is not quite as lucrative as it once was. Indeed, it is now considered a great bit of luck to find a diamond-back or two in the mud.

It took 11,300,081 horse power to carry on our industries in 1900 and 5,594,655 in 1890.

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## HATHAMITE.

BY WALDON FAWCETT.

Hathamite, the newest and what is claimed to be the most powerful known explosive, is the invention of Mr. G. M. Hathaway, of Wellsboro, Pa., a scientist who has devoted years of experiment to the solution of the problems involved in the manufacture of this new source of energy. Hathamite, which has, of course, been named for the inventor, is a coarse powder of bluish-gray tint. The impunity with which the explosive may be handled under ordinary conditions constitutes one of its most remarkable characteristics.

OPEN EXPLOSION OF ONE OUNCE OF HATHAMITE.

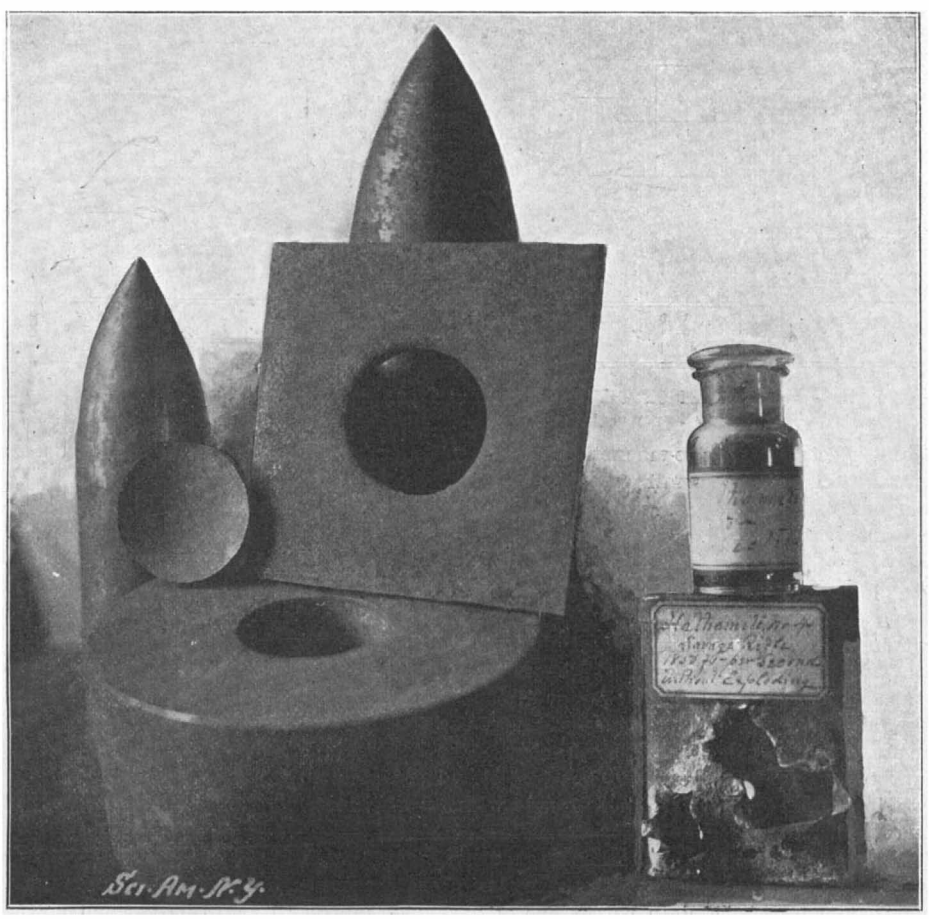
Lighted matches may be thrown into it without producing any effect, and a handful of the explosive may be laid on an anvil and pounded into impalpable powder with a sledge. Similarly, shells may be exploded near a quantity of hathamite without inducing disastrous results, and finally rifle balls fired into small masses of it are likewise without influence. This latter is, in a way, the most severe test to which an explosive may be subjected, and consequently no little surprise was created when, at the recent initial demonstration of the properties of hathamite, the inventor filled a tin box with the explosive and fired rifle balls through it at a speed of 1,850 feet a second.

Once subjected, however, to the combination of flame and concussion supplied by a percussion cap, hathamite generates great explosive energy. However, the powder can only be exploded when a dynamite percussion cap of large size is used. The cap itself must be powerful. To illustrate this, light percussion caps were, in a recent test, placed in two ounces of hathamite and fired without exploding the material.

Thus far the only demonstration of the capabilities of hathamite has been made in tests of a purely experimental character. In one of these a small charge of the mixture, when exploded upon a sheet of one-quarter inch boiler plate, cut a hole in the steel as cleanly as it could have been accomplished by means of a machine. On another occasion a small charge of hathamite was placed between two large cakes of ice, each weighing in excess of one hundred and fifty pounds. The powder was allowed to remain between the ice cakes for nearly an hour and was then exploded by means of caps. All that remained of the ice cakes after the explosion was a small pile of snow—not finely crushed ice, but snow of the ordinary character. This test is particularly interesting as evidencing the possession by the explosive of properties which will allow of its use in mining operations in Alaska during the winter.

In a second test, in which circular pieces two inches in diameter were blown from one-quarter inch boiler plates, cutting the plate as clean as a die, one and a half ounces of hathamite formed a charge, and in each case was simply placed upon the plate and detonated in the open air. A collar of steel placed under the boiler plate in one instance served as a bed against which the steel was cut clean. In the test mentioned the heavy steel collar, three inches deep and made of the toughest steel, was broken into several pieces by the force of the explosion. On one occasion about one ounce of hathamite was exploded in a regulation United States government one-pound steel shell, and very thorough fragmentation of the shell occurred. A similar result followed the explosion of two six-pound shells in a heavy steel chamber, there being employed in this instance 3⅛ ounces of the explosive. In this experiment the hathamite was melted and run solid into the shells. A hole was then drilled into the explosive and primed with two grammes of granulated explosive, which was acted upon by the fuse.

The explosion of a small charge of hathamite produces a sharp report, somewhat resembling the crack of a rifle, and there arises a rather thick cloud of greenish smoke, but this quickly dissolves in the air. When, in order to demonstrate the safety of hathamite under ordinary conditions, the explosive has been poured upon flames or a bed of coals, it has burned slowly and with an immense amount of smoke.




DISK CUT FROM STEEL PLATE BY THE EXPLOSIVE.

CAN OF HATHAMITE THROUGH WHICH BULLETS HAVE BEEN FIRED.

### Purifying Water by Means of the Electric Current.

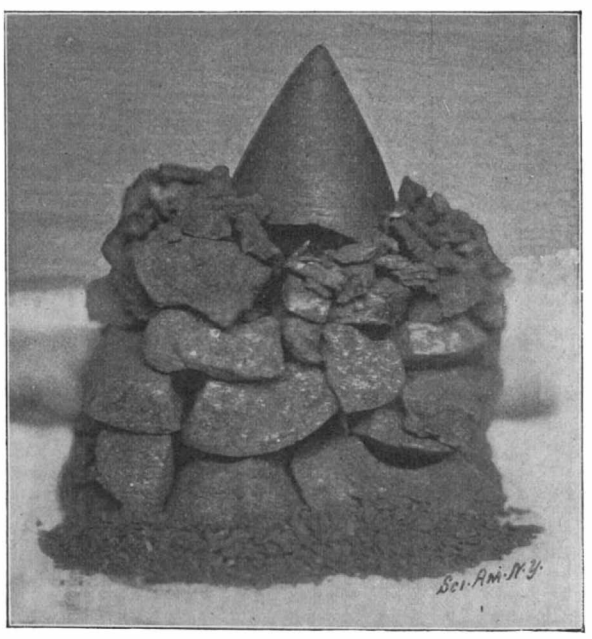
A large syndicate has been formed and is now preparing to begin extensive operations to exploit the process of purifying water by the means of the electric current. The patent is that of C. E. Holland, of New York, and the company is the Electric Purification Company. An experimental plant has been in operation for some time at Chartiers Creek, near Pittsburg, where the practicability of the system has been fully demonstrated, and a proposition will be made to the city of Pittsburg to purify a portion of the city's supply at first, and then all of it, and after this an effort will be made to introduce the system in other large cities. The inventor says that the cost of an electrical plant for this purpose, capable of supplying 75,000,000 gallons per day, would not cost more than $100,000, and after the installation of the plant the cost of purifying the water, as near as can be figured on the basis of the small plant now in operation, would be about 28 cents for a million gallons.

### Automobiles.

BY EGBERT P. WATSON.

Surprise is sometimes felt by laymen at the speed attained by automobiles, but from an engineering aspect it is a natural result of the forces applied. Take the case of an automobile weighing 2,000 pounds more or less—one short ton. Such a vehicle would have an engine of or rated at 40 horse power and be capable at racing speed of a velocity of 60 miles an hour. A locomotive of 100 tons weight will develop at high speeds 1,000 horse power, and draw a load behind the tender of say 200 tons at 60 miles per hour. In the former case, of the automobile, the power available is as 40 to 1, while in the locomotive it is only 5 to 1, so that it is not singular that the former should, even upon common roads, attain high velocities. Comparison of the work done by the two types is not made, because it is not an element in this discussion.

The frequency of accidents occurring through the use of automobiles has prejudiced many unthinking persons, who decry them as dangerous to the public safety, but these same persons ignore the numberless casualties arising from horses before the automobile was heard of. It is urged that the latter are in the hands of careless persons, unskilled in the knowledge of mechanism, but the same may also be said of the horse. Those who employ him are quite as ignorant of his internal arrangements, and come to grief just as quickly as those who have a thorough training in his anatomy. Knowledge and familiarity with machinery in action is by no means superfluous to drivers of automobiles, and there is no question that study of their principles would be of great benefit to all concerned, and such accidents as have occurred arise usually from lack of ordinary care and precaution. All machines in motion require attention constantly to keep them up to their work, but modern vehicles of the class in question have been so perfected that a person of ordinary skill and intelligence can easily control them. To do this, however, without disaster involves close supervision at all times, for an automobile upon a comparatively rough highway is liable to swerve from its course if there is a very slight obstruction in it. One forward wheel meets with a check and the machine is diverted. In going at high speed it is very difficult to get it back in its place immediately, for the momentum of a heavy body going at an ordinary speed has to be reckoned with; it is of importance that the steering gear should be firmly in hand at all times.




FRAGMENTATION OF A 6-POUND SHELL BY HATHAMITE FILLER.

Legislative enactments to limit the speed of automobiles upon highways are generally based upon the danger to others using them, but there are two aspects of this proposition, one of them being the injustice to owners of automobiles, and another that it has not been established that the machine itself is a source of danger. The horse is a vagarious animal; any horse is. According to his moods, he will accept one day a real peril with equanimity, and the next shy at the family wheelbarrow if he comes upon it unexpectedly. He will endure placidly the spectacle of an express train not fifty feet away, belching thick smoke and steam in his very face, but a harmless piece of paper or a barnyard fowl hen squawking upon a fence fills him with unspeakable terrors. To assert that automobiles have changed the disposition of horses in general is very difficult to establish; and while one may have misbehaved at the passage of an automobile, there is no proof that at that particular period of the horse's existence he would not have been equally perturbed at anything else. The sole object, or at least the principal object, of the introduction of automobiles is rapid transit upon common roads, and a demand for such vehicles has existed for years. Inventors have studied the subject in all its aspects; now that they have attained success, the first thing that is done by authorities is to reduce the speed to that of horse-drawn wagons. Fast driving in towns or villages, whether by horses or machines, is dangerous to pedestrians and others using the streets; there can be no argument upon that head, and all vehicles should be limited to the condition of common traffic; but outside of towns automobiles should be permitted to travel at speeds of at least twenty

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miles per hour without encountering the displeasure of some rural Dogberry anxious to earn his perquisite. Doubtless after the public shall become more familiar with mechanically-driven vehicles the present objections to them will disappear in great part; likewise better knowledge of the capacities and peculiarities of the machines themselves upon the part of their owners will enable them to avoid many of the present mishaps.

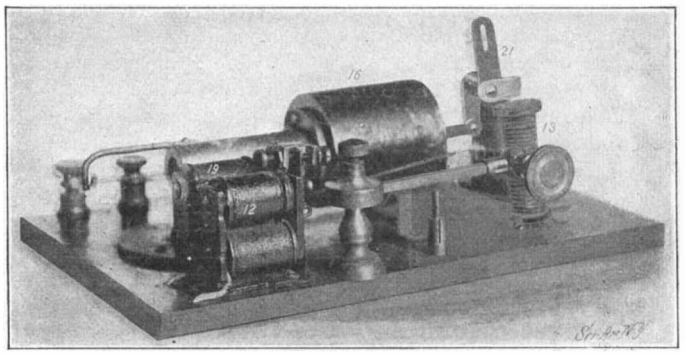
## THE AUTOMATIC TRAIN CONTROLLER.

Despite the greatest precautions in the way of pneumatic and electric signals, serious railroad accidents are continually occurring. In devising these signals inventors do not take into account the personal element—the individuality of the engineer—which plays such an important part in many crises. We have read of engineers who, when suddenly confronted with danger, seem powerless to act, and rush on to destruction without making the slightest attempt to stop the train. In explaining the cause of a wreck which occurred in this vicinity, a railroad official of high standing said that it was probably due to that mad recklessness which sometimes overtakes an engineer, making him disregard all signals and risk his own life and that of the passengers. Obviously, then, the best perfected system of automatic signals, even though working perfectly, would be deficient in cases where the man at the throttle was blind to their warning or too dazed and bewildered to know just what to do. The only proper way to provide against all contingencies is to devise some suitable means, whereby the warning of danger would be immediately communicated to the engine, closing the throttle and applying the air brakes without the medium of human agency. In other words, since man is sometimes unreliable in critical situations, we must look for some trustworthy substitute which may be depended upon to act without fail in all emergencies.

A substitute of this character may be found in the system which is herewith illustrated. This system, which has been developed by the Automatic Train Controller Company, of 25 Broad Street, New York, is very simple, and the apparatus employed is very compact, being arranged to occupy not more than a cubic foot of space and, with the exception of the electrical mechanism which acts directly on the throttle and air-brake valve lever, the parts may be stowed away in any convenient corner of the engine cab. A complete understanding of the electrical action may be had by a glance at the diagram. The track is laid out in block sections of any desired length, the rails 5 at one side being electrically disconnected at the end of each section, and the opposite rails being electrically connected throughout the length of the track. At the end of each section, preferably between the rails, is a contact rail 7, which is electrically connected with the rails 5 of the section immediately ahead. Arranged upon the forward end of the locomotive, and preferably on the pilot, is a contact lever 8 designed to engage with the contact rails. This lever is pivoted on a shaft 9, from which the contact finger 10 extends upward and is adapted to normally engage the contact piece 11 carried by the pilot. The contact finger 10 is electrically connected to one pole of a battery, or other source of electrical power, conveniently located on the locomotive, while from the other pole a wire extends to an electro-magnet 12 and thence back through a resistance coil 13 to the contact piece 11. Magnet 12 is thus normally energized and its armature 14 attracted against the action of a spring. The current follows this course at all times except when a contact rail 7 is encountered. At such times the lever 8 is raised, rocking the finger 10 out of contact with the terminal 11. The armature of magnet 12 acts as a switch in a separate circuit comprising the battery 15 and electro-magnet 16, and when released from the attraction of this magnet serves to energize the electro-magnet 16, the armature, 21, of which, operates the air brake valve lever.

Whenever a new block section is about to be entered the contact at terminals 10 and 11 is broken as stated above, and if the track is clear, the current flows from the battery through lever 8, contact rail 7, rails 5, resistance 17, at the end of the section and back through rails 6, trucks 18 of the locomotive, and magnet 12 to the battery. In case of an open drawbridge, or broken rail, or where wreckers attempt to wreck the train by tearing up the rails, as shown in section 3 of the diagram, this flow would be interrupted, and the magnet 12 being de-energized would release its armature, thereby closing the circuit of the battery 15 through electro-magnet 16. The electro-magnet being energized, attracts its armature 21 which operates, through lever and link connections, to shut off the steam, and apply the air brakes, thus automatically bringing the train to a safe and gradual stop before it can enter the dangerous section of track ahead.

In case of a train in the block section ahead, the circuit through the electro-magnet is closed through a different medium. Connected in parallel with the magnet 12, is a magnet 19 which is provided with an armature 20. This armature also serves as a switch for the circuit of battery 15, but differs from armature 14 in that it is normally held back against the attraction of its magnet by the tension of a strong spring. Normally the attraction of the magnet 19 is unable to overcome this spring tension; but when the resistance in the track is short circuited by the trucks of a train, it develops sufficient energy to attract its armature and close the circuit of battery 15. We have already stated that resistance 13 is cut out of the circuit whenever the lever 8 rides over contact rail 7; but at the same time the resistance 17 of the section is looped in, and is such as to produce practically no change in the flow of current. However, if the current were short circuited by the trucks of a car, or a locomotive, in



APPARATUS FOR AUTOMATICALLY CONTROLLING TRAINS.

the block, as shown at 21 in section 4, a materially increased flow of electricity through magnet 19 would result, and the armature 20 would be attracted, closing the circuit through electro-magnet 16 which would stop the train as described above. Provision is made against any breaks in the roadbed as well as against danger of collision, and since the parts are self-restoring, they resume their original position when the cause of the danger is removed, thereby indicating to the engineer that the section ahead is clear.

Accidents are sometimes caused by cars on a siding which have not been drawn clear of the main track, but project over the same. In order to prevent such accidents, a section of the siding immediately adjacent to the switch is connected by shunt wires to the main track circuit, so that in case a car is standing in dangerous proximity to the main track, the current will be short circuited through the car tracks and the train approaching that section would be stopped. The apparatus is perfectly reliable, and no fears may be entertained of its failure to act in an emergency; for it will be observed that the parts are so arranged that, unless everything is in perfect order, one or the other of armatures 14 and 20 will be operated to complete the circuit through electro-magnet 16, thus bringing the train to a stop. In order to make the system doubly safe, the

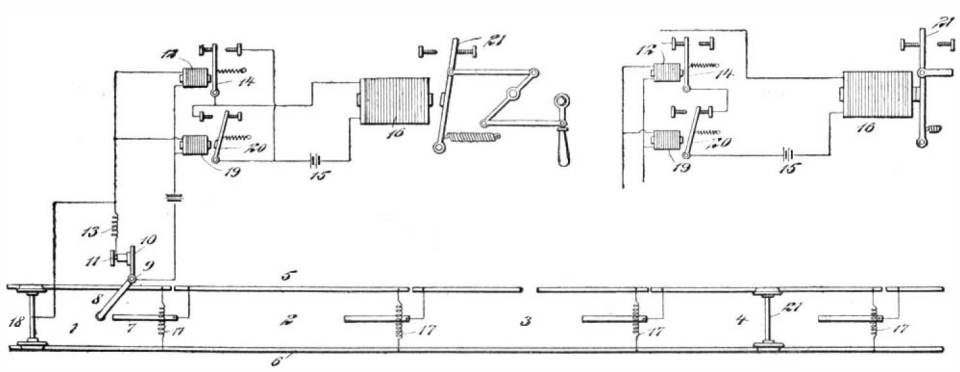


DIAGRAM OF THE AUTOMATIC TRAIN CONTROLLER SYSTEM.

electro-magnet circuit may be arranged according to the small diagram at the right. This arrangement provides an unbroken circuit when the conditions are normal. In case of danger, however, the current is interrupted by one or the other of armatures 14 and 20, and the electro magnet 16 is de-energized, releasing the lever 21, which, thereupon, springs back and operates the throttle and air brakes. Should either of the batteries employed become weakened or should any of the parts be broken or disconnected, the engineer would be immediately apprised of the fact by the automatic action of the mechanism. The Automatic Train Controller Company has just closed contracts to equip one of the Eastern railroads with its machines.

Acetylene has been experimented with for signaling in the Germany army, with great success. Mixed with a certain percentage of oxygen it is said to give three times the light of the oxy-hydrogen lamp and can be plainly observed in daylight at a distance of five miles. This distance is trebled at night.

### The Decay of Beachy Head.

The seven white miles of Beachy Head are fast crumbling away. The great chalk cliff in front of the lighthouse of late years has shown signs of insecurity, which in 1893 culminated in a very heavy fall, amounting, it is estimated, to no less than 85,000 tons of chalk. Again in 1896 another dislodgment occurred of an estimated quantity of 89,000 tons. By these serious downfalls the distance between the lighthouse tower and the cliff edge was reduced from 100 to 70 feet, and there are not wanting signs that further disintegration of the cliff may sooner or later take place. Thus has arisen the necessity for a new lighthouse, on a more stable and enduring site. The new lighthouse was fully described and illustrated in the SCIENTIFIC AMERICAN.

### New York as a Foreign City.

In the city of New York there are only 737,477 white persons born of native parents, or but 21.4 per cent of the population of the city. This statement means that out of every one hundred persons living within the municipal boundaries of New York seventy-eight are either foreigners, or the children of foreign-born parents, or colored people. New York, however, is not the first, but the second city of the country having the largest foreign-born population. Fall River, Mass., is first in that respect. Official figures show that there are in New York city more males under twenty-one years of Slavonic parentage than of any other people, and the number of Slavonic men more than twenty-one years of age exceeds that of any other nationality except Germans and Irish. In the Fourteenth Assembly District of New York County the percentage of Hebrew families with nine children each is six times as great as the Protestant percentage, while the number of Hebrew families with no children is about one-half the Protestant percentage.—H. McMillen, Leslie's Weekly.

### Ether-Air Gas.

Descriptions have been published recently of a new form of artificial illuminant made by saturating air with the vapor of ether, and then carbureting the whole with benzol. Ether-air gas itself has found occasional use for years under the name of eth-oxygen gas, being employed for optical lantern work in places where the oil light was too weak, and coal gas not laid on. A new carbureter has been invented in France which is claimed to be specially suitable for ether. The absorbent material is the fiber of a palm-like tree, which has an apparent specific gravity of from 0.114 to 0.122, and is so extremely porous that it will take up nine times its weight of ether, all of which is subsequently evaporated into the gas. Ether itself burns with a luminous, or even smoky flame, but when it is diluted with air, its vapor, as in ether-air gas, gives a blue flame, and, for purposes of illumination, requires either a mantle or the addition of benzol vapor. According to Langlois, incandescent ether-air gas gives a light of 1 Carcel-hour—about 9.5 candles—for every 6.7 grammes of ether burnt; while the material will bear cooling to 21 deg. Fah. without any of the ether condensing out, and without suffering any diminution in illuminating power. By carbureting ether-air gas with 40 or 50 grammes of benzol per cubic meter, a product resembling oil gas in stability can be prepared. It is stated that carbureted ether-air gas is almost twice as expensive as oil gas; but it has an advantage over the latter in the simplicity of the plant required, and in the rapidity with which a small installation can be erected. It may be noted that the introduction of this ether-air gas renders the term "air-gas" as applied to air carbureted with petroleum spirit ambiguous; and the latter product must now be called "petroleum-air gas," or something of the kind.—Engineer.

### Galileo and the Magnetic Telegraph.

In his dialogues on the Ptolemaic and Copernican cosmogonies, which first appeared in 1627, Galileo places in the mouth of one of his interlocutors, Sagrado, the words: "You remind me of a man who wanted to sell to me the secret of communicating with a person two or three miles distant, by means of the sympathy of two magnetized bars. When I told him that I would gladly buy his secret, but that I first wanted to see the thing proved, and that it would be sufficient for my purposes to communicate with him in his room while I was stationed in my own room, he answered that the operation could hardly be observed at so small a distance. Thereupon I dismissed him, saying that I had neither the desire nor the time to travel to Cairo or Moscow, but that if he would journey to either of these two places, I would gladly act as his correspondent in Venice."

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### Electrical Notes.

The city of San José, California, recently inaugurated its system of electrical lighting. The current is carried for a distance of 173 miles from a plant situated in the very heart of the Sierra Nevada Mountains. The current is used not only for the purpose of illumination, but also for driving the street cars and machinery of the various manufactories.

According to the London Electrical Engineer, successful results are said to have been obtained by a Mr. Storey, of Lancaster, on Lake Windermere with a boat steered from the shore by an adaptation of wireless telegraphy. The experiments were conducted in private, and no particulars are to hand as to how Mr. Storey accomplished his reported achievement. It is stated, however, that he was able to steer the boat from the shore, directing it in safety in and out of a fleet of sloops and steam launches at their moorings.

On October 13 a special train on the Grand Trunk Railway made a trip that will probably be historical. The train passed through Montreal on October 13 bound for Portland, Me. On board a complete set of wireless telegraphy apparatus had been installed for the purpose of experiment. Moving at a speed of sixty miles an hour it was possible to receive messages clearly on the train. Communication was first established eight miles from St. Dominique and continued uninterruptedly until the station had been left eight miles behind.

A paper was read before the British Association at Belfast on the electrical conductivity of certain aluminium alloys as affected by exposure to the London atmosphere. The specimens exhibited were in the form of wire, 0.126-inch (3.2 mm.) diameter, supported on a wooden frame; they were exposed on the roof of a building for thirteen months. It is assumed that the observed effects are principally due to pitting at the surface, but exposure might also affect the structure. The position of aluminium in the electrochemical series with respect to the other substances used is as follows: *Al, Mn, Zn, Fe, Ni, Cu, Si.* It should be expected that copper, widely separated as it is, would be effective in the production of corrosion. This is found to be the case, the effect increasing with the percentage of copper. Nickel is well separated from aluminium in the series, and alone has considerable effect, but if alloyed with copper the conductivity increases slightly during exposures. This specimen is specially promising, as it has a breaking load of 45,900 pounds, and limit of elasticity 36,600 pounds per square inch. It has a comparatively low percentage extension, a high coefficient of expansion, and a low temperature coefficient for electric resistance. Again, iron in the presence of nickel has a slightly increased conductivity. The results of the analysis of the different experiments before and after exposure are given in a table. For exposed aluminium alloys it appears that copper alone should not be used in the alloy; the presence of equal amounts (about one per cent) of nickel and copper certainly reduces conductivity by a small extent, but the increase in mechanical and the decrease in corrosive properties is great.

Haber and Geipert have been investigating the conditions under which aluminium is obtained by the electrolytic method, and have published their results in the Zeitschrift f. Elektrochemie. They point out that no trustworthy details of the method employed in the various works where the metal is now produced have hitherto been made public. Using a small experimental fusion cell, and the ordinary lighting supply current of the Karlsruhe Technical Institute, they were able to reduce alumina without difficulty and to obtain as much as 230 grammes of the metal in one operation. The metal obtained was remarkably pure, one sample tested containing only 0.05 per cent C and 0.34 per cent Si. The mechanical tests made with six samples of the aluminium gave an average tensile strength of 21,425 pounds per square inch. The fused mixture used in the carbon cell contained 33 per cent $AlF_3$, 33 per cent NaF and 33 per cent $Al_2O_3$, the high percentage of aluminium fluoride being conducive to fluidity. The current density employed was about 2,800 amperes per square foot, and the E. M. F. varied between 7 and 10 volts. The authors, as the result of their experiments, have come to the conclusion that the steady improvement in the efficiency of the process as carried out in the aluminium works is due, not to secret modifications in the process, but to the more careful attention now given to the purity of the raw materials employed. They also point out that the carbon contained in the aluminium obtained in their experiments was not present in the combined form, and as it was graphitic in character they assume that it represented mechanically inclosed particles, due to the disintegration of the anode and cathode carbon. By remelting the aluminium it was possible to remove a portion of this impurity from the metal. The necessity of employing carbons comparatively free from ash is insisted on, since any impurities of the carbon used will be found in the final product.

### THE INFLUENCE OF GRADES.

Automobilists and cyclists know, of course, that more force is required to climb a hill than to run on a level. But few know just what the relation is. When they consult a text-book, they generally run into a formula which contains "the sine of alpha;" and that usually finishes their investigations. I purpose to give a rule that is just as good, for all practical purposes, as can be had by using a table of sines, which in any case is not always accessible even if it would be comprehended by the wheelist or automobilist.

When any vehicle runs on a level road, the amount of traction (that is, the amount which would be indicated by pulling through a spring balance placed between the vehicle and the motive power if the latter preceded the vehicle as in horse traction) runs on a good surface from 1-80th to 1-50th of the weight of the vehicle, according to the character of the road surface and that of the bearings, tires, etc. That is, a 25-pound wheel would call for about half a pound of pull, and could be towed by a thread which would hold up a weight of eight ounces; and if the road were good, a 40-pound tricycle could be towed by the same half-pound effort.

On level stone pavements of good class it takes 1-40th to 1-30th of the weight of the ordinary wheeled vehicle to tow it; and on macadam in bad condition 1-20th; that is, a 20-pound racer would here take a pound to tow it empty. We will say for average road surfaces 1-30th the weights; which would give us for a one-ton automobile nearly 75 pounds average.

The books tell us, and with reason, that the extra traction on up grades increases directly as the sine of the angle of the grade; and refer us of course to a "table of logarithmic sines" for long fine work, or a "table of natural sines" where there is not much figuring to do.

That is, if we had a hill, *AC*, with an angle, *ACB*,

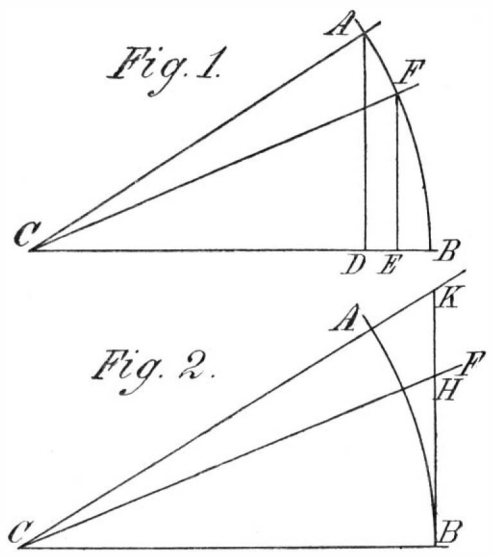


DIAGRAM SHOWING METHOD OF COMPUTING GRADES.

counting from the level, we would have the necessary increased tractive force, compared with that on a hill, *FC*, in the same proportions as the lines, *AD* and *FE*, dropped "plumb" from the ends of the arcs (that is, from the ends of the inclined radii, also) to the horizontal radius. And if we know the angles, *ACB* and *FCB*, we can get these "sines" for a radius, 1, from a table of natural sines and cipher it up that the increased traction is equal to that on a level, multiplied by the natural sine of the angle.

But road grades are not reckoned by angles; they are counted by so much rise per mile or per hundred feet or other convenient standard unit—as for instance "1 in 100," or "10 feet to the mile," or what not. Now this "rise" per hundred feet of horizontal distance corresponds exactly to the tangent of the angle of the grade; and the natural tangent is so near the natural sine that for our purposes, where the angles are small anyhow, we can use it to multiply by.

In the second figure we have the same grades, *AC* and *FC*, the same radii, *AC* and *BC:* but instead of the sines (dropped plumb from the ends of the inclined radii to the horizontal radius) we have the tangents, *BH*, *BK*, raised plumb from the end of the horizontal radius to the inclined radii produced. In both cases the lines, sines and tangents, start from an intersection of one arc with a radius.

Now using the tangent instead of the sine, we find that on any grade the amount required to tow the vehicle is equal to the original weight times the coefficient (this coefficient being 1-20th or 1-30th or 1-40th or what not, according to the grade and the condition of bearings, tires, etc.) plus the extra traction, which latter is the weight times the per cent of grade.

If this is the case (i. e., this being the case, which it practically is) we have with a coefficient of 1-30th = 3 1-3 per cent, double the traction as soon as we have a 3 1-3 grade, and triple where we have a 6 2-3 per cent grade; and when we reach an up grade of 10 feet in a hundred, four times the power is needed that would suffice on a level.

For better roads, where our coefficient is 1-40th instead of 1-30th, we have for a ten per cent grade five times the tractive force which is necessary on a level; and where we have the very best roads usually attainable, and run our traction on a level down to 1-60th the weight of the vehicle, then we need, on a 10 per cent up grade, 6 2-3 times as much as on the level. The better the roads, the greater the proportionate bad influence of grades. There are roads in France, and perhaps also in Germany, where the traction coefficient runs down to 1-80th; and here a 10 per cent up-grade calls for nine times as much power as a level!

So, in figuring up the power required to mount a hill, remember that comparatively more "notching up" is required where the roads are good than where they are bad!

### Transportation in Madagascar.

With the completion of the road between Mahatsara, on the east coast of Madagascar, and Tananarivo, the capital, it is now possible to transport goods for a distance of 200 miles. To be sure, goods are transported not entirely upon land, but partly over this newly completed road, and largely by waterway formed by a series of lagoons and canals. It is hoped that before many years have passed the roads and canals will give place to a railway which is to lie between Tamatave and Tananarivo.

In order to transport goods to the coast, Hova carriers are employed to carry huge packs through the mountains. With the completion of a new road the Hova porter will be compelled to seek a new field of employment. Between four and five thousand porters usually made the trip through the mountains to the coast. When the new road was finished, carts immediately began to displace the Hovas. Where three wagons were used last January, 372 were used in June.

To be sure, the cartage is still rather primitive; for the vehicles are hauled by men. If human power is used to draw these carts, the question naturally arises, How is it that the Hova carriers are compelled to seek other employment? The reason is to be found in the fact that each cart, having a carrying capacity of 750 pounds, is drawn by three men; whereas the Hova carrier, however strong he may be, can hardly bear more than 100 pounds. When oxen and mules are substituted for men, we may expect a reduction in the price of cartage transportation.

### The Current Supplement.

The current SUPPLEMENT, No. 1401, opens with a continuation of Mr. F. C. Perkins' article on "The Berlin Underground and Elevated Railway." The present installment is just as copiously illustrated as was the last. The question of using oil fuel in the United States Navy has been fully discussed in a report prepared by the Bureau of Steam Engineering. The current SUPPLEMENT contains the first installment of that report. M. Berthelet discusses researches on argon and its combinations. "Radio-Activity and the Electron Theory" is the title of an interesting paper. Dr. Lorenz's operation is concisely described. "New Apparatus for Short Distance Stereoscopic Photography" forms the subject of an exhaustive article. The French first-class battleship "Gaulois," which it will be remembered figured prominently during the Rochambeau celebration in this country, is described and illustrated. Mr. Henry Clay Weeks gives some practical suggestions on mosquito extermination in New Jersey. Mr. A. Wehnelt, inventor of the interrupter that bears his name, discourses interestingly on the distribution of current at the surface of cathodes in vacuum tubes. The usual Selected Formulæ, Trade Notes and Recipes and consular information are also published.

### $2,197,789,824 of Money in Circulation.

The total stock of money of all kinds in the United States on September 1, as reported by the Treasury Department, was $2,579,306,217, being an increase of $67,446,684 over that on the same date last year. The amount in circulation was $2,197,789,824, which, based on an estimated population of 79,344,000, is a per capita of $28.55. The per capita on September 1, 1901, was $28.18, and on the same date in 1900 was $26.85.

### Spencer's Latest Feat.

On the afternoon of October 20, Stanley Spencer, the aeronaut who recently made a successful trip over London, made an ascent at Blackpool, in Lancashire. After traveling about 26 miles, he descended near Preston. There was a good breeze when he ascended. At about a height of 1,000 feet he made several evolutions, and finally sailed off in the direction in which the wind was blowing. Spencer almost collided with an express train in descending, but escaped by ramming a tree. No serious damage was done.

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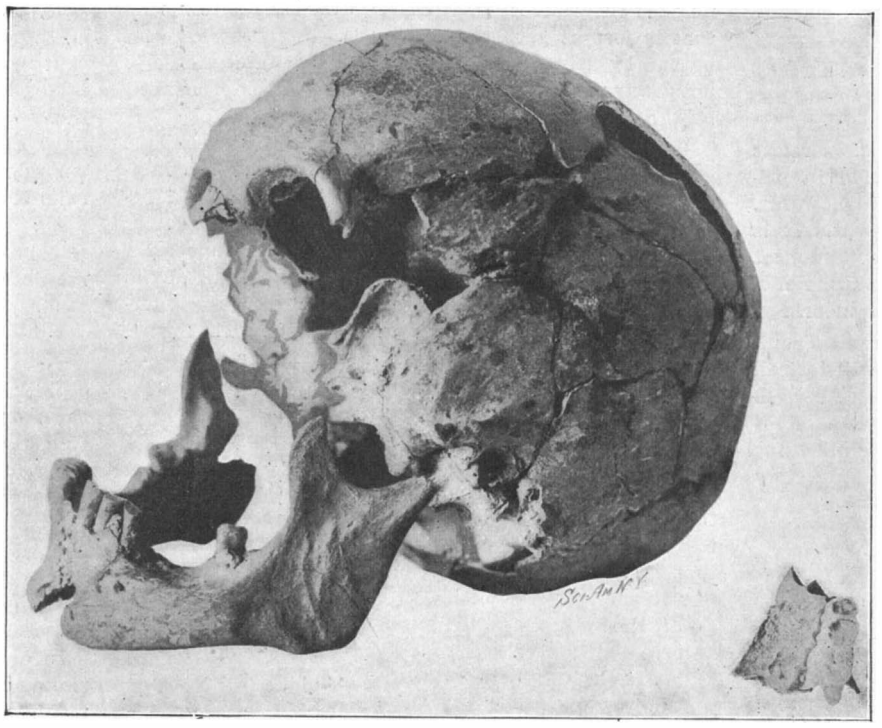
## THE LANSING SKELETON.

Among the subjects discussed by the International Congress of Americanists, held at the American Museum of Natural History, was the antiquity of man. One of the exhibits was the "Lansing Man," consisting of a skull and a few bones said to be at least eight thousand, and, perhaps, thirty thousand years old, found by a farmer near Lansing, Kans., last February.

In the opinion of Prof. Upham, the Lansing skeleton offers probably the oldest proof of man's presence on this continent; yet it is only a third, probably only an eighth, as old as the flint hatchets of St. Acheul. It has been estimated that man in the Somme Valley and other parts of France, and in Southern England, made good paleolithic implements fully a hundred thousand years ago. When the earliest man came to America cannot probably be closely determined. It may have been during the glacial period; it may have been earlier. In Prof. Upham's opinion, the Lansing discovery gives us much definite knowledge of a glacial man, dolichocephalic, low-browed, and prognathous, having nearly the same stature as our people to-day. Prof. Williston believes that the Lansing man was doubtless contemporary with the equus fauna, well represented in the late Pleistocene deposits of Kansas, which include extinct species of the horse, bison, mammoth and mastodon, moose, camels, llamas and peccaries. He was also the contemporary of the late paleolithic men of Europe, whose advanced implements showed that they had developed beyond the stages of primitive savagery.

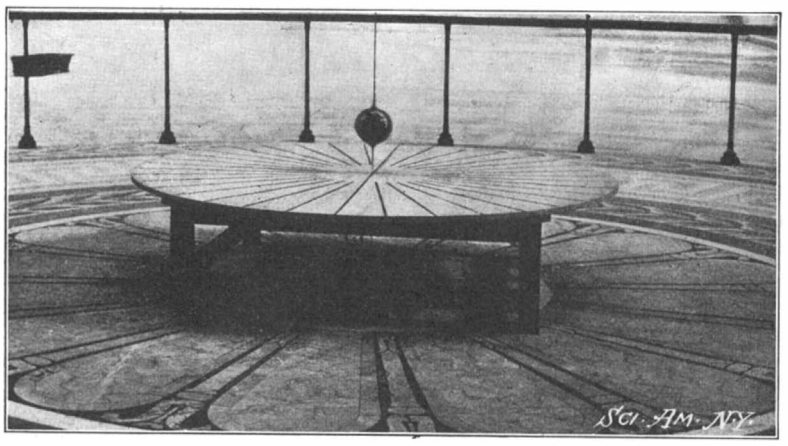
At the International Congress referred to, anthropologists, if not more cautious in their estimates than Prof. Upham, were at least not so enthusiastic. Dr. G. A. Dorsey, of the Field Columbian Museum, who presented the skull to the Congress, considered that it was that of a man fifty-five years of age, six feet in height, whose lower limbs showed greater development than the upper. In his opinion the skull was practically identical with the skull of the ordinary Indian of the plains. Dr. Hrdlicka, who has made a very careful investigation of the Lansing man, states that: "The inevitable conclusion from the examination which was conducted, absolutely without any prejudice or preformed opinion, is that the Lansing skeleton is practically identical with the ordinary male skeleton of a large majority of the Middle and Eastern States Indians. Any assumption that it is thousands of years old would carry with it not only the comparatively easily acceptable assumption of so early an existence of man on this continent, but also a very much farther reaching and far more difficult conclusion, that this man was physically identical with the present-day Indian, and that his physical characteristics during all the thousands of years assumed as having passed since his existence, have undergone absolutely no important physical modification."



THE SKULL OF THE "LANSING MAN."
Variously estimated at from 8,000 to 30,000 years old.

## THE PANTHEON EXPERIMENTS WITH FOUCAULT'S PENDULUM.

Newton was the first to conceive the idea of experimentally proving the diurnal movement of the earth. He reasoned that as the earth revolves, all the points of its surface must have an angular velocity which increases with the distance from the ideal axis of rotation, which ceases at the poles, and which reaches its maximum at the equator. As a result of the movement of the earth, the summit of any edifice moves from west to east more rapidly than its base. Hence it follows that if a ball of lead is dropped from the top of a tower, preserving its initial velocity during the fall, it should strike the ground a little to the east of the foot of the vertical dropped from the starting point.




THE TABLE OVER WHICH THE PENDULUM BOB SWUNG.

Experiments have confirmed this idea. Benzenberg, at the beginning of the nineteenth century, actually measured with precision the deviations which occurred in the interior of a church tower, and of a mining shaft, notwithstanding the restricted height from which the bodies fell. Later, Léon Foucault resorted to the pendulum in order to demonstrate the rotation of the earth.

It was in 1851 that Foucault made his classic experiments in the Pantheon at Paris. Unfortunately, the *coup d'état* of December 2, 1851, interrupted his investigations. It was determined at a recent meeting of the Société Astronomique de France to repeat his experiments. All that is left at the Pantheon to mark the investigations of 1851 is the balustrade over which many an eager observer hung when Foucault carried out his work. Camille Flammarion was deputed to repeat the observations of the apparent displacement of the pendulum. The bob used was not that of Foucault, but that of the pendulum employed by Maumené at the Cathedral of Rheims. Its weight, however, was the same, 28 kilos. In order to suspend this massive weight, a piano wire 67 meters long and 72 millimeters in diameter was employed.

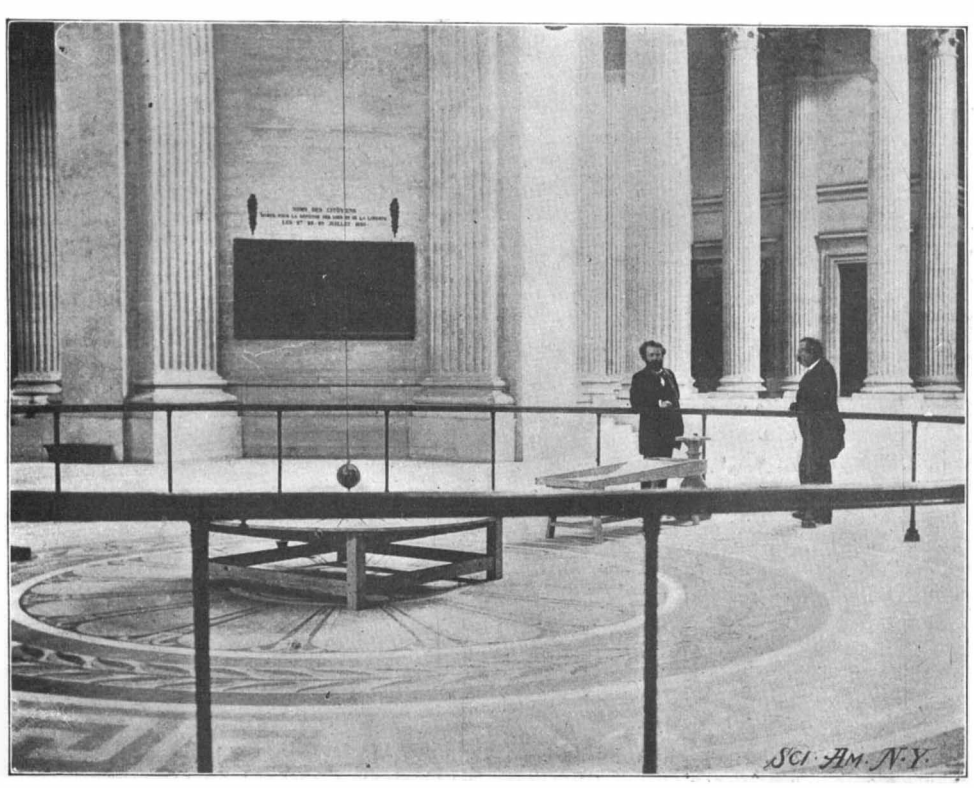
The duration of each beat of the pendulum expressed in seconds is equal to the square root of the length expressed in meters. For example, the duration of oscillation of a pendulum 64 meters in length is 8 seconds for a single beat. For a complete oscillation the time is 16 seconds. Since the total length of the Pantheon pendulum, measured from the center of the bob, is 67 meters, the duration of a single beat is 8.2 seconds. A double beat would, therefore, require 16.4 seconds. The pendulum was allowed to oscillate for several hours, the amplitude of its beats gradually diminishing.

The mechanical principle of the experiments is based on the law that the plane in which a pendulum oscillates remains fixed even though the point of the suspension of the pendulum be caused to turn. This principle can be demonstrated by means of a very simple apparatus. A small pendulum is mounted in a frame of wood, supported by a table. While the pendulum is oscillating the apparatus is caused to turn slowly. The direction of the plane of oscillation will remain the same.

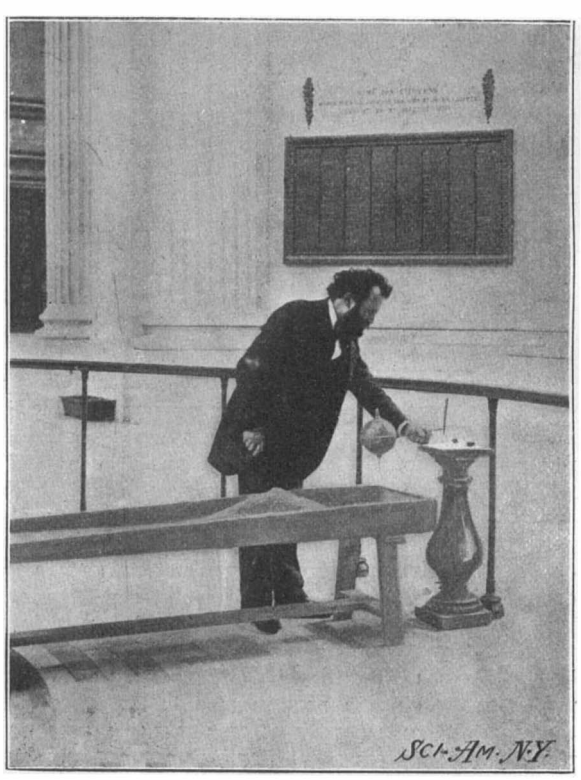
If a pendulum were hung over the North Pole, the plane of its oscillation would remain invariable despite the rotation of the suspending wire. The earth will turn under the bob and the plane of oscillation will apparently revolve once in twenty-four hours around the vertical, in the direction contrary to the true movement of the earth's rotation; that is to say, from left to right, like the hands of a clock. At the South Pole the same phenomenon could be observed; only the plane of oscillation would seem to turn in the other direction by reason of the observer's changed position. It is evident that if the plane of oscillation seems to turn in a certain direction at one side of the terrestrial equator, it will appear to turn in the contrary direction at the other side. The plane of oscillation ought to appear immovable at the equator. There is no reason why it should seem to turn in one direction any more than in another, the observer at the equator during the twenty-four hours of rotation of the earth being always in the same position relatively to the oscillating pendulum.

If we shift the scene of this experiment to our own latitude, the phenomenon becomes more complicated, because the vertical from the point of the wire's suspension which, at the pole, is confounded with the axis of the earth, and has a fixed direction, now participates in the movement of the earth and describes a cone about that axis.

The plane of oscillation of the free pendulum, com-




THE SAND-FILLED TROUGHS AND THE TABLE AS THEY APPEARED IN THE PANTHEON.




FLAMMARION STARTING THE PENDULUM BY BURNING THE SILK STRING WHICH HOLDS IT.

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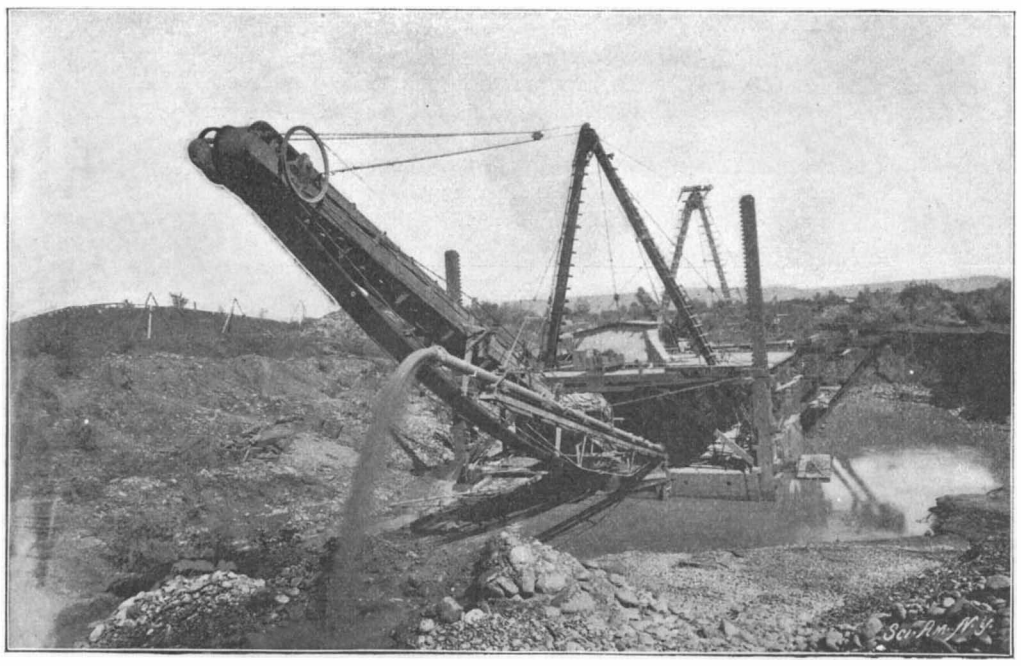
pelled by the action of gravity to pass constantly by this vertical cannot preserve a fixed direction in space; but, according to one of Foucault's theories, which has been confirmed by rigorous computation, it will swerve the least possible distance at each instant from the direction of the previous instant. As a result of this principle, it will be found that the apparent deviation of the plane of oscillation relatively to the horizontal mark of its original position, is proportional to the sine of the latitude. Equal to the rotation of the earth itself at the pole, this deviation will gradually decrease as it approaches the equator, and will then become zero. We may, therefore, say with Foucault: "Even in midocean, completely out of sight of land, a pilot, his eyes fixed on the compass, knows the change of direction accidentally imparted to his ship, just as the inhabitant on the earth can create for himself, by means of the pendulum, a kind of compass arbitrarily directed in absolute space, the movement of which apparently reveals to him the actual movement of the earth which supports it."

This experiment is one of the most magnificent lessons of astronomy which can be given to the public; it is the most convincing, practical proof which astronomical science can offer of the earth's movement. By its means we can assure ourselves with our own eyes that we are living on a moving planet.

The bob of Foucault's pendulum used by Flammarion carried a point which, as the pendulum swung, made a furrow in a layer of sand spread upon a table and contained in troughs at each side of the table. After each oscillation the retrogradation of the oscillating plane could be observed. At Paris, the latitude of which is 48 degrees 50 minutes, the deviation of the pendulum is 11 degrees 17 minutes 33 seconds per sidereal hour; and 31 hours 48 minutes are necessary for an entire revolution of the oscillating plane.



A LAVA-BED DREDGER.

### A New Pacific Record.

The new steamer "Korea" of the Pacific Mail Company arrived at San Francisco from Yokohama at noon, October 28, after having broken the record across the Pacific. The steamer made no stop between the coast of Japan and her home port. Her average speed was 470 miles a day. The distance from Yokohama by direct line to San Francisco is 4,000 miles. The "Korea" sailed from the Japan port on October 18, and made the passage in ten days.

The beautiful broken bronze statue of Hermes, found at the bottom of the sea near the Island of Anticythera, south of Cape Matapan, in the spring of 1901, has been pieced together. As restored the statue is rather more than life-size, and the most admirable example of the finest Greek workmanship.

### DREDGING FOR GOLD.

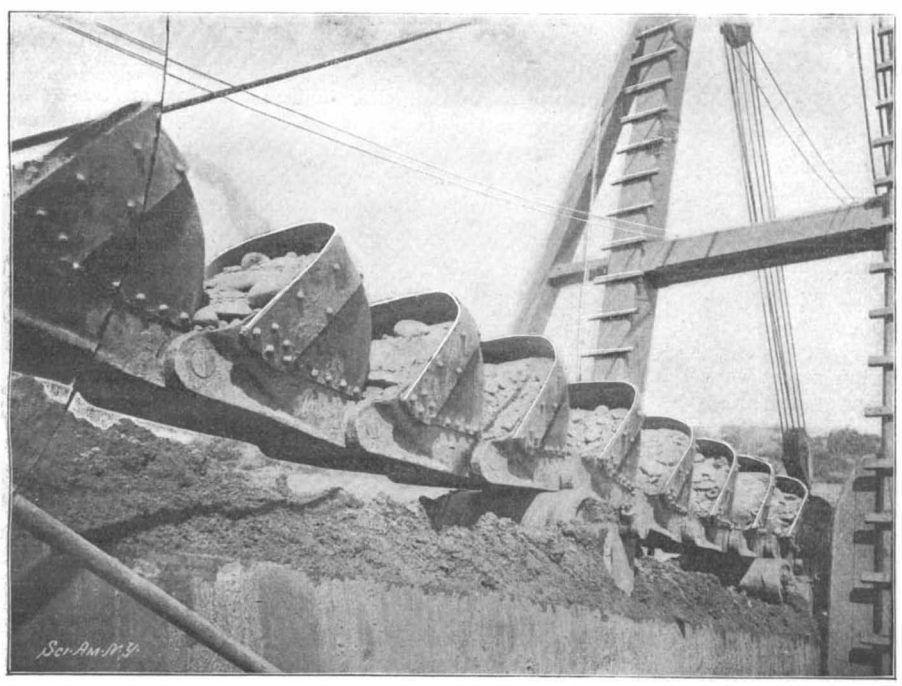
BY ENOS BROWN.

Gold dredging as carried on at Oroville, Butte County, California, is as interesting to the expert as it has proved profitable to those engaged in it. The locality has been famous for its prolific output from the earliest period of gold mining in California. A bedrock, so called, underlies the entire district at an average depth from the surface of 30 feet. Below this, it is understood by local investigators, it is useless to penetrate. Theorists assert, however, that underlying the territory are successive deposits each marking successive stages of the river in times far distant.

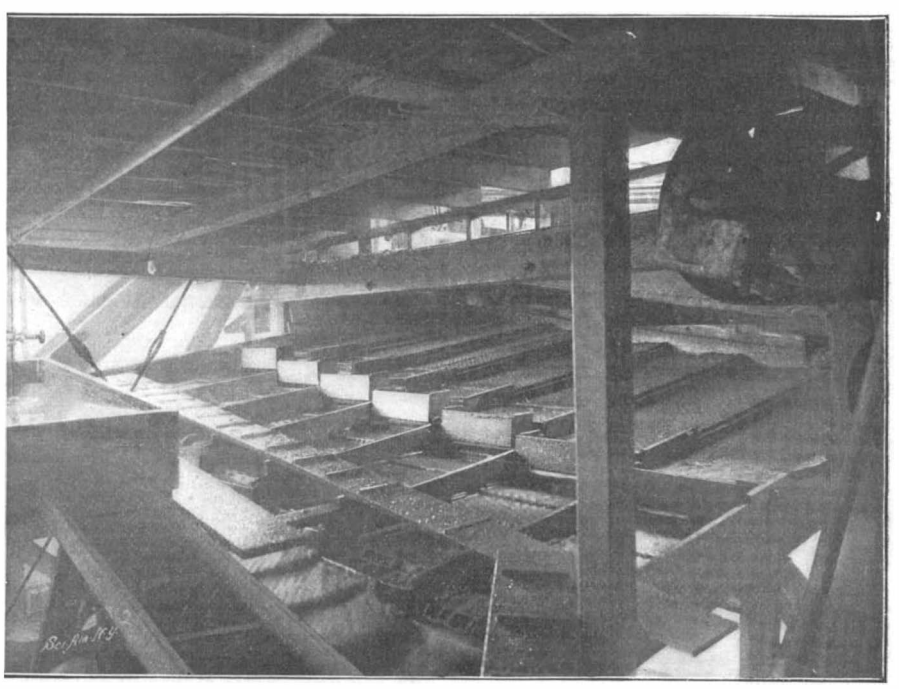
Over this bedrock has gradually accumulated a heavy stratum of soil consisting of a base of gravel and bowlders surmounted by a layer of fertile loam. Naturally, the soil nearest the bedrock is the richest in treasure.

The soil above bedrock is the deposit of Feather River, which is the largest affluent of the Sacramento. In its lowest stages the Feather never carries less than 250,000 miners' inches of water a minute. At Oroville the river flows from the foothills of the Sierras through a rocky and precipitous cañon and with tumultuous current. The channel passes through an exceedingly fertile region, in an auriferous sense, and for ages the torrents had been employed in grinding from exposed quartz ledges minute fragments of rock, containing gold, which were carried along with the current and only deposited when a quiet basin and still waters were reached. This happened at Oroville, where a broad plain of 5,000 or more acres spreads out in perfect level. Through this the river has meandered with subdued current, gradually depositing its rich sediment, until after ages of uninterrupted effort it has filled it to a depth of 30 feet and over, not a square yard of which does not contain gold in definite amounts. The basin is generally level and the ground both "tight" and "loose," the difference being well understood. "Tight" ground is the most difficult to handle. In different localities there is variation in the richness of the deposits. The gold saved is known as "washed river gold" appearing in small grains and flakes of exceeding purity, realizing $18.50 and $18.60 an ounce at the United States mint.

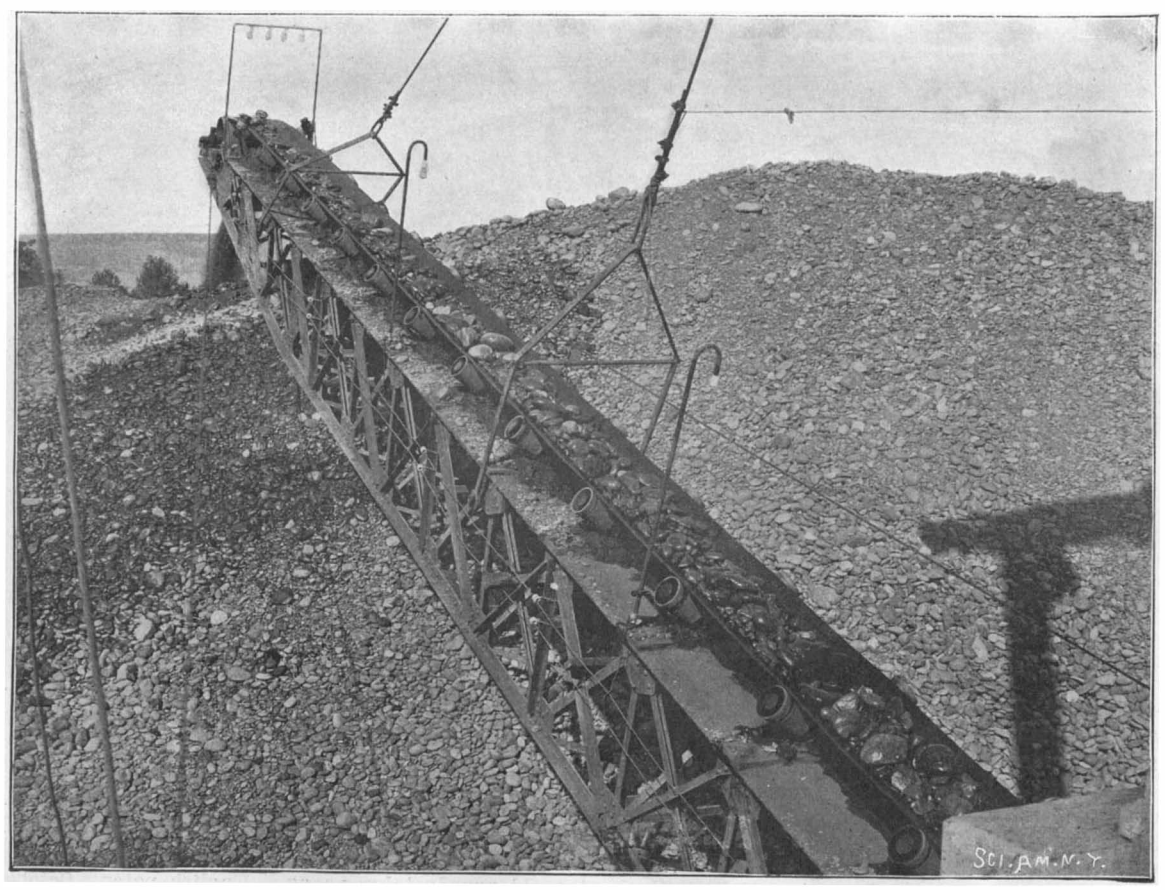
In earlier years the district has not been mined to



A CONTINUOUS BUCKET DREDGER.



THE GOLD-SAVING TABLES OF A CALIFORNIA DREDGER.



THE "STACKER" OF THE DREDGE "INDIANA" PROVIDED WITH A ROBBINS CONVEYOR.

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any great extent though known to be rich. The efforts of individual miners being desultory and contracted owing to the difficulty of controlling the too copious flow of water, which was utterly beyond the limited mechanical ability of the placer miner to dispose of. Bedrock, where the richest deposits lay, could not be exposed without some powerful mechanical auxiliary to eject the overwhelming floods. Neither was the value of the deposits great enough to stimulate the expenditure of all the labor required in order to secure it, for the average of gold throughout the basin does not exceed 30 cents a cubic yard.

These obstacles were effective in discouraging individual attempts and reluctantly the miner concluded that the problem was beyond his solution and one which could only be solved by mechanical means. Since then inventive genius has exercised its utmost efforts to overcome the difficulty, but met with no success until within three years past. The region is the grave of a hundred abortive inventions. Mining experts who had exhaustively studied the situation agreed that the extraction of gold could be effected by dredging, provided a process of the required power for working immense masses of material containing such low values as here existed and at a cost that could afford a margin of profit, could be introduced, the aim being to construct a dredger that would excavate, wash, sluice, handle and discharge the waste gravel at a continuous and single operation, to pick up, digest and eject in the same movement. Experimental effort was exhausted on all known methods of gold dredging with but a measure of success, and it was not until 1898 that the difficulties were finally overcome.

The single bucket dredger has been transformed into those astonishing and complete mechanical devices by which the riches of the Oroville district are being made available. To stand by these powerful machines and observe the ease with which great masses of soil containing bowlders, some weighing 100 pounds, are torn up from depths of 30 feet by buckets attached to a chain having a tensile strength of 500 tons, each bucket containing 4, 5 or 6 cubic feet and then carried over a gantry 19 feet 6 inches in height, where it is dumped into a hopper and, after being washed, carried into a revolving, perforated cylinder, where the fine dirt is dropped into the sluice boxes below and the coarse gravel and bowlders are passed to the conveyor and automatically carried to the rear. Like the bucket chain which is adjustable to greater or lesser depths, the conveyor or tracker can deposit its load to a height, if necessary, of 35 feet above the ground.

The work of the dredger never ceases, but for cleaning sluice boxes. The average amount of earth handled is, according to the size of dredger, from 1,000 to 3,000 cubic yards each day. The monthly capacity of the largest is one acre to a 30-foot depth per month. The cost is 5 cents for each cubic yard, and the estimated expense for running a dredger of the first class, $1,800 to $2,000 a month. One of the great dredgers in use by the Leggett Wilcox Company was made by the Risdon Iron Works and is now operating in "tight" ground, and for that purpose is of extra strength. It will dig from 30 feet below to 15 feet above water level. The ladder consists of a heavy lattice girder with ½-inch side plates 3 feet deep. The bucket chain carries 32 heavy buckets of 5-foot capacity. The main gantry is of steel, 19 feet 6 inches high. The bucket belt dumps 12½ buckets a minute, or 150 cubic yards an hour, and is driven by a 50 horse power induction motor. The material is dumped into a steel delivery plate which conveys it to the revolving screen. Under the delivery plates are three sets of bar grizzlies. The revolving screen is 4½ feet in diameter and 25 feet long, perforated with ⅜-inch holes. The water supply is furnished by two centrifugal pumps, one delivering 2,000 gallons a minute into the screen through a perforated pipe, and the other supplies water into the distributing box. The gold and fine material passes through the perforated screen into the distributing box and over 300 square feet of standard tables. The sand and small gravel is then delivered behind the dredge by a sluiceway.

The Bucyrus dredger, operated by the same company, is of somewhat larger capacity, and is working efficiently in "loose" ground, which it handles at the rate of 3,000 cubic yards each 24 hours. The distinctive feature of this dredger is the close-connected bucket principle, and also the peculiar shape of the buckets, which admit of side digging. The conveyor belt is of rubber. The dredger is driven by a 110 horse power motor, and the buckets hold each 5 cubic feet.

No. 712,316
THE UNITED STATES OF AMERICA
TO ALL TO WHOM THESE PRESENTS SHALL COME:
Whereas John Henry Dee 3d William Paul Dee
of Paris France
HAVE PRESENTED TO THE Commissioner of Patents A PETITION PRAYING FOR THE GRANT OF LETTERS PATENT FOR AN ALLEGED NEW AND USEFUL IMPROVEMENT IN
Electric Accumulators
A DESCRIPTION OF WHICH INVENTION IS CONTAINED IN THE SPECIFICATION OF WHICH A COPY IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND HAVE COMPLIED WITH THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED, AND
Whereas UPON DUE EXAMINATION MADE THE SAID CLAIMANT HAS ADJUDGED TO BE JUSTLY ENTITLED TO A PATENT UNDER THE LAW.
NOW THEREFORE THESE Letters Patent ARE TO GRANT UNTO THE SAID
John Henry Dee 3d William Paul Dee, their HEIRS OR ASSIGNS
FOR THE TERM OF SEVENTEEN YEARS FROM THE twenty eighth DAY OF
October ONE THOUSAND NINE HUNDRED AND two
THE EXCLUSIVE RIGHT TO MAKE, USE AND VEND THE SAID INVENTION THROUGHOUT THE UNITED STATES AND THE TERRITORIES THEREOF.
In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington
twenty eighth day of October
year of our Lord one thousand nine hundred and two and of the
independence of the United States of America the one hundred and twenty seventh
Commissioner of Patents
PATENT OFFICE UNITED STATES OF AMERICA

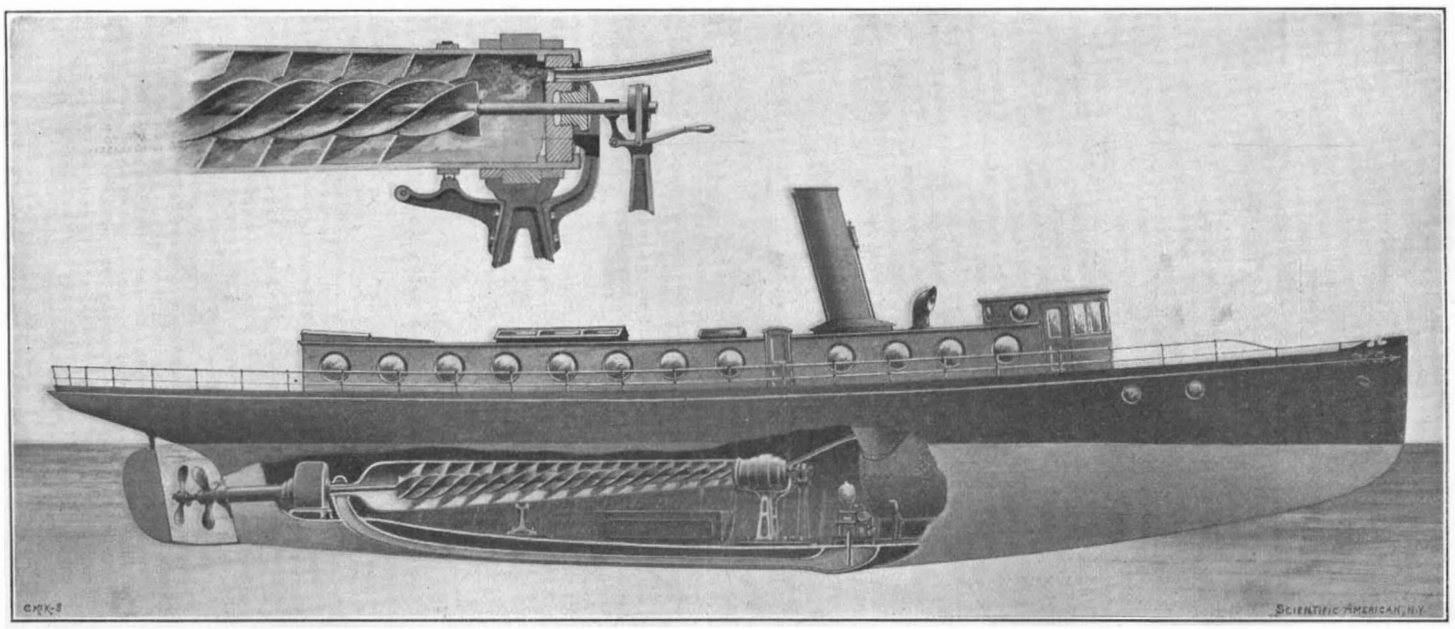
**FAC-SIMILE OF THE NEW UNITED STATES LETTERS PATENT.**

A dredger known as the Marion steam shovel has been introduced and is in successful operation.

Altogether there are now fourteen of these great dredges operating in the Oroville basin, with six others under construction, which will give a dredging capacity of twenty, handling 35,000 cubic yards of earth daily.

None of the dredges of this district operates in the river, the anti-debris laws of the State preventing. A location is selected within the tract, and upon this ground the hull of the dredger is built. When ready to launch, a small basin is excavated and filled with water from a local irrigating ditch. Into this miniature lake, of dimensions just great enough to float the dredger, it is launched, and operations begun. It there remains until the ground available is washed over. A dredger of the greatest size exhausts about twelve superficial acres of gold-bearing ground a year.

The monthly profit of the larger dredgers, though not publicly reported, is believed to be in excess of $12,000. Values from the borings referred to are sometimes less than 60 cents; the highest ever known was $2.71.



**COL. J. J. ASTOR DEDICATES HIS MARINE TURBINE PATENTS TO THE PUBLIC.**

Jerusalem is supplied with water from King Solomon's "Sealed Fountain," seven miles south of the city. The water is conveyed partly through modern iron pipes, but partly by the old aqueduct known as Solomon's Aqueduct.

## THE NEW COVER DESIGN FOR UNITED STATES LETTERS PATENT.

The United States letters patent for inventions, granted on October 28, 1902, appeared in a new dress. The terms of the grant have not been changed, but the cover on which the grant is engrossed, bears embellishments of new design. To those who are familiar with the appearance of the old patents, the accompanying fac-simile illustration will therefore be of no little interest. The new design presents a curious optical illusion. At first sight it appears as if the new cover were smaller than the old, although both are exactly the same size. The illusion is doubtless created by the ornamental border.

## COL. J. J. ASTOR DEDICATES HIS MARINE TURBINE PATENTS TO THE PUBLIC.

To the Editor of the SCIENTIFIC AMERICAN:

All my patents on marine turbines having been granted, I hereby dedicate them to the public, in the hope that the development of the ideal turbine may be hastened thereby.

The turbine is shaped like a funnel, and comprises an outer shell or drum and an inner shaft running axially through it, these parts being relatively rotatable and each having oppositely set spiral blades. The steam is admitted into the outer shell at the small end and passes through the turbine, expanding into the large end of the shell and acting on the spiral blades to rotate the shell and shaft simultaneously and in opposite directions. By allowing both the inner turbine and the outer case to revolve, the speed necessary to insure efficiency, which in ordinary turbines is often inconveniently high, is cut in half. As a result of this construction the weight is reduced practically fifty per cent.

By passing the inner solid shaft through the outer hollow shaft or drum, the structural advantage of running both through the sternpost of the ship is obtained, this being the strongest part. Moreover, the shafts are incased and protected for almost their entire length without changing the shape of the hull. Retaining all the advantages of twin screws, the propellers are little exposed to danger in docking as in a ship with a single screw.

Since both propellers revolve on the same axis, in opposite directions, but little power is wasted in imparting a rotary motion to the water, for after the passage of the ship the water is left entirely dead except for the necessary reaction resulting from driving the ship ahead.

To sum up, the following appear to me the principal advantages: 1, reduced weight; 2, higher steam efficiency; 3, higher mechanical efficiency, by reason of the reduced size enabling the parts to be fitted more perfectly, permitting the diminution of friction and also the reduction of the leakage loss; 4, such a turbine would seem to be particularly suitable in central station work for generating electricity, in which case the field and armature may be driven in opposite directions. This would improve the efficiency of the dynamo and increase its output for a given weight. This principle is obviously also applicable to gas engines.

Further particulars and details concerning pumps, condenser, etc., may be obtained from the Patent Office at Washington by ordering a copy of patent No. 690,821, granted to me on marine turbines, or from the office of the SCIENTIFIC AMERICAN, 361 Broadway, N. Y. city, through which agency I obtained my patents.

The French patent is dated September 28, 1901; the English patent, October 1, 1901.

New York, November 1, 1902. J. J. ASTOR.

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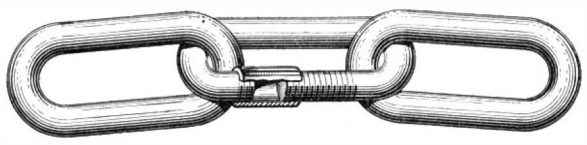
### ODDITIES IN INVENTIONS.

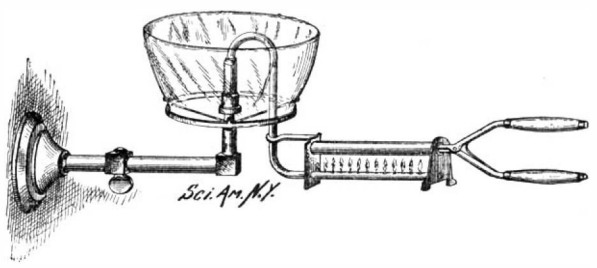
DETACHABLE CHAIN-LINK.—Instead of sending a broken chain to a blacksmith to be repaired, and thereby losing much time, William H. Baker believes it would be a good idea to use a detachable link, which can be used to splice the broken chain. The loop of



A DETACHABLE LINK.

steel comprising the link is not closed at the ends. A fixed opening is left for the insertion of another link. The ends of the loop are threaded. Upon one of the ends a sleeve is mounted which can be screwed on the other end so as to close the opening in the link.

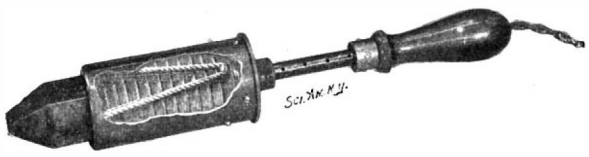
A CURLING-IRON HEATER.—An inventor who lives in Kansas City will probably earn the gratitude of every woman who uses a curling-iron. It is a common practice to hold the iron in a gas flame until it becomes hot. That takes time; and the arm grows tired.




A GAS-HEATER FOR CURLING-IRONS.

This inventor has, therefore, devised a gas-heater which can be slipped over a jet. The gas-heater comprises a gooseneck pipe with a long, horizontal end, provided with burner apertures. The curling iron is thrust in a tube over the burners and thus heated.

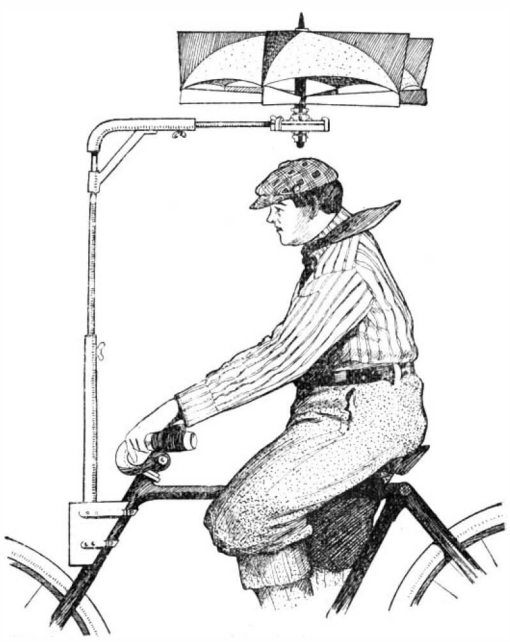
ELECTRIC SOLDERING IRON.—Electrically-heated irons have been made in a number of ways, but that devised by Henry Geisenhoener and Tycho Van Aller and made by the General Electric Company, of Schenectady, N. Y., seems to embody noteworthy improvements. The point of the iron is provided with a shank, which is surrounded with a coil of small




AN ELECTRIC SOLDERING IRON.

wire, the turns being insulated from each other and from the shank by an interposed coil of insulating material wound back and forth between two concentric layers of wire. This structure forms an open network of wire and insulation through which air can circulate freely, so that when the coil is heated by its resistance to a current of electricity, the heat readily reaches the shank of the soldering iron. An inclosing insulated jacket prevents undue radiation of the heat.

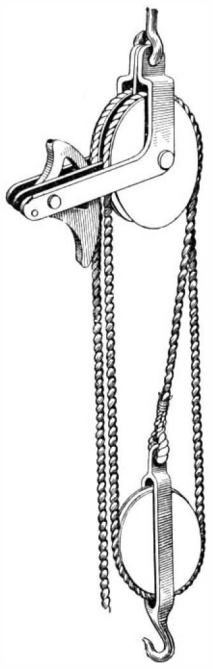
BICYCLE FAN AND SHADE.—A combined fan and canopy is a device which has recently been invented especially for the use of bicycle riders. The canopy is made in the form of an ordinary umbrella, and is provided with a number of blades. As the bicyclist spins along, the wind will strike the blades and rotate the umbrella-like canopy. Thus the rider is both



A BICYCLE UMBRELLA-FAN.

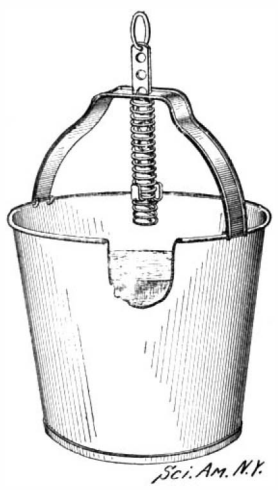
cooled and protected from the sun. The canopy is carried by a frame which can be attached to the bicycle in the manner shown. The frame can be readily taken apart.

TACKLE-BLOCK HOIST.—An automatic grip for tackle-block hoists is the subject of an invention which presents interesting mechanical features. The frame of the hoist is composed of two rectangular members, and another member which comprises only the vertical arm. A pulley pivot connects these members. As many members can be employed as desired, this being determined by the number of pulleys employed in the hoist. A cam is pivoted between the horizontal arms, and the several members are separated by the pulleys and secured together to the top in any suitable way. Normally the cam hangs away from contact with the rope. The angular frame is maintained in the required position by the weight of the tackle-block suspended from the rope. One end of this rope is free to engage the cam and is held by the operator, while the other end is secured to a hook or some portion of the tackle-block. When it is desired to release the weight, the rope is swung in and held vertically to release the cam, thereby allowing the rope to run free, the cam swinging out from the pulley.



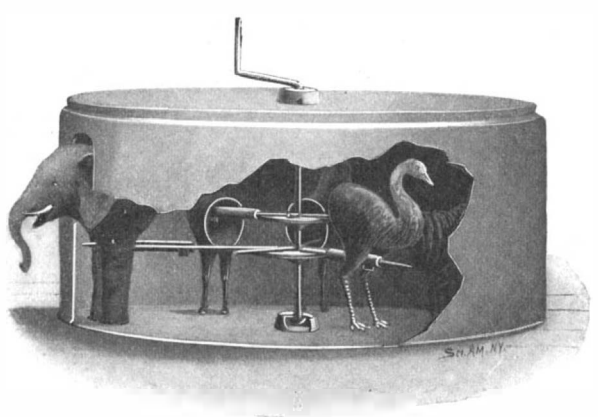
TACKLE-BLOCK HOIST.

A LIQUID SCALE.—If a tradesman wants to know the weight of a liquid which he is selling, he has but to provide himself with a bucket for which William Buschmann, a New Jersey inventor, has obtained a United States patent. The bail of the bucket is provided with a central opening through which an index rod penetrates. A spring engages the lower end of the rod and a portion of the receptacle, while a suspending device is connected with the index rod above the bail, the index rod having openings which the inventor calls "tactile indices." By means of these openings the quantity by weight of the liquid in the bucket can be determined according as the one or the other of the openings registers with the bail where the index rod penetrates it. The openings are provided especially to enable measurement by feeling the rod with the fingers, a feature of particular importance if the bucket is filled in a dark cellar.




A WEIGHING BUCKET.

MECHANICAL TOY.—A cheap and simple toy which is designed to afford instruction and amusement to children has recently been invented by Mr. Honrath, of 5 West End Avenue, New York city. The device comprises a number of toy animals contained within a casing having a doorway through which the animals may be arbitrarily brought to view. A vertical shaft is mounted centrally in the casing. The lower end of this shaft has a foot-piece which is housed within a cavity in the bottom plate. The upper portion of the shaft passes




MECHANICAL TOY.

through a boss in the top plate and is bent to form a crank. The boss referred to serves to prevent the crank from rubbing on the top plate of the casing. On the shaft are one or more hubs from which a series of arms project radially. Each arm is equipped with a sleeve slidably mounted thereon, and on these sleeves the toy animals or objects are fastened. These objects may be made of sheet metal, papier mache or any other suitable material, and they are so located as to project through the doorway in the casing when desired. The objects are prevented from turning on the radial arms by stop pieces secured to these arms and projecting through slots in the sleeves. The stop pieces serve to limit radial movement of the sleeves, so that the objects cannot be entirely withdrawn. In using the toy the crank is turned to impart rotary motion to these objects which, by reason of their rapid movement, will not be visible through the doorway. When the parts come to rest one of the objects will be opposite the doorway, and by tilting the casing this will slide down into view. This action can be repeated at will and the probabilities are that no animal will present itself at the gateway twice in succession, so that the varying forms which the occupant of this mysterious box seemingly assumes will prove of great interest to the children.

### Brief Notes Concerning Patents.

General Crozier was formally installed as the head of the Bureau of Ordnance on June 28, after a long struggle made against his appointment to the place. The opposition was based on the fact that he is the inventor of a large number of mechanisms designed for army use, and as the head of this branch of the service he would be called upon to pass on innumerable other devices, and the claim was made that under the circumstances he would not be able to give an unbiased judgment. This objection was largely removed by displacing him from the Board of Ordnance and Fortifications.

A new car coupling is being tried on the line from Berlin to Oranienburg, which has for its object to lessen the space between the cars. With this system, the distance has been reduced to 20 centimeters (7.8 inches). The buffers are the same as in the old cars, but the springs, which are a little shorter than before, are built into the cars, thus making the shorter couplings possible. The question has been raised if the shortening of the couplings will not bring about an increase of danger from collisions. Careful trials, however, have proved that this is not the case, as the effect of the buffers remains the same as in the old system.

A Swedish engineer, Mr. T. F. Malmros, has invented a lubricator for oiling piston-rods, cylinders, and guides on locomotives. By introducing the intermixed oil and steam, coming from the central steam-lubricating apparatus, through glandular bushings expressly constructed for this purpose, the invention has effected a good and economical lubrication of packings and rods, as well as of the cylinders and guides. The system has for five years been tested on the engines of the fastest train in Sweden, with such good results that all locomotives of the State railroads will be provided with it. This seems to be a revival of the old lantern brass used in the Cornish engine.

Herman O. Moritz, of No. 473 Fifth Avenue, Brooklyn, the inventor of a device called the aerial toboggan, was killed at Coney Island on June 12 while getting his toboggan slide in shape for operation. He had secured a patent on the thing with some difficulty and commenced the construction of the first one about three years ago, but until recently he was refused permission to operate it because of the danger. During the past spring, however, he modified the plans to such an extent that the building commissioners gave him the desired consent and preparations were being made to send the first car over the slide when it slipped from the chains which were holding it and started off "wild." The inventor was standing at the foot of the incline, and the car struck him with such force as to hurl him a great distance and injured him so seriously that he soon died.

Commissioner of Patents Allen said in a recent interview that the number of patents granted during the present year would be greater than that of any previous year, by far. This great increase in the number of patents granted always takes place at such times as the present, when prosperity prevails, and the receipts of this department of the government are said accurately to reflect the condition of the money market. The previous experience of the present Commissioner as a patent lawyer made him thoroughly familiar with the former shortcomings of the department, so that during his administration he has been enabled to remedy a great many of them. The system of the bureau has been bettered, to such an extent that litigated cases, if appealed immediately from one examiner to another, may be tried and passed up by the three tribunals of the department within sixty days from the time of the institution of the original contest. "This," says the Commissioner, "is faster than the attorneys generally wish." Out of all the applications last year, one in fifteen hundred was carried to the District Court of Appraisers.

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# Legal Notes.

PROPERTY IN A NAME.—The selection of a suitable title for a business is a matter of no small difficulty, for the reason that many conflicting interests must often be considered and that the good-will which attaches to the name of a firm of long standing is not to be weighed lightly. A frequent cause of trouble between firms carrying on the same trade is the adoption of similar trade names. It is a matter of common knowledge that if one trader adopts the name of another a court will presume that he has done so for a sinister motive. But there are other forms of this piracy which demand much closer investigation. In a recent number of Engineering, these various forms have been classified and shrewdly analyzed from the standpoint of British law. The classes include, (a), cases of a person using his own name, which happens to be the same as that of some firm doing a similar business; (b), the cases of a firm taking in a partner whose name when added to that of an existing firm gives rise to confusion; and (c), the case of a firm adopting a title similar to, but still substantially different from that of a trade rival.

A case which comes under the first head is that of Aerators, Ltd., against Automatic Aerator Patents, Ltd. The plaintiff company, who are the proprietors of the well-known "Sparklets," sought to restrain the defendants from using the name Automatic Aerator Patents, Ltd., on the ground that it so nearly resembled its own name as to be calculated to deceive. An injunction to restrain the use of the defendant company's name was refused, for the reason that, giving words their ordinary meaning, no one was likely to be deceived. Further, it was not competent for any company or person to claim the sole proprietorship of any words in common use. Perhaps still clearer was the case of Holloway vs. Holloway. The defendant Henry Holloway commenced selling pills as H. Holloway's pills in boxes similar to those of the plaintiff, Thomas Holloway, intending to pass off his pills as the plaintiff's. He was restrained by injunction. Again, where a man named Day, having obtained the authority of one Martin to use his name, set up in business as Day & Martin and sold blacking in bottles with labels similar to those of the well-known firm. He was restrained by injunction. These cases illustrate the proposition that fraud vitiates everything.

In the absence of fraud, however, a man may use his own name in his own business, no matter what may be the consequences to his neighbors. The case of Turton vs. Turton is regarded in England as a leading authority in support of this proposition. The plaintiff had for many years carried on the business of steel manufacture in Sheffield, under the title of Thomas Turton & Sons. The defendants were John Turton and his two sons. John Turton had commenced a business very similar to that of the plaintiff's in partnership with one Lawton, under the name of Turton & Lawton. After a few years Lawton retired, and the sons of John Turton entered into partnership with their father under the firm name of John Turton & Sons. When the case came up on appeal the court held that the defendant did nothing in the way of his trade which tended to give another meaning to the name in which he carried on his business, or which could give any other meaning to it, than the mere fact that he did carry on his business and was in partnership with his sons. The plaintiffs had no right to say a man may not use his own name. In this country the court would undoubtedly inquire whether the public suffered by the similarity in names; whether it bought the goods of one man under the supposition that it was buying the goods of the other.

The next question to consider is whether a trader has the right to use a particular title in describing goods acquired by him. In dealing with this question it is necessary to point out the difference between a trade-mark and a trade name. A trade-mark is invented and assumed by a man for the purpose of selling his goods, and there is no necessity for anybody else putting that mark upon other goods, unless the mark is meant to identify them in such a way as to represent that they are the goods of somebody else whose goods are identified in the same way. With regard to a trade title it is a question of degree; that is to say, the court has to decide whether by a particular course of dealing a man has acquired the right to monopolize the use of a particular word or phrase. Thus, in one case it was held that there was no monopoly in the use of the word "magnolia" as applied to metal, as it had become well-known in the trade as a substance peculiarly adapted for bearings in machinery. In this country it is held that where a trade name is so intimately identified with the object to which it is applied, that the object cannot be readily identified without it, the public acquires the right to use it, after the usual statutory conditions have been fulfilled. Where a brewer had manufactured ale at Stone for a number of years so that his ale became known as Stone ale, an injunction was granted to restrain the defendant, who had only recently come to the town, from selling ale under the appellation of Stone ale or Montgomery Stone ale.

In cases between trade rivals, the plaintiff, as a general rule argues: "I complain that you have passed off your goods as mine, which they are not;" or "You are passing off my goods as yours, which they are not." The English and American courts are inclined to prevent both forms of piracy. The case of Bullivant vs. Wright illustrates what kind of passing off will be restrained. The plaintiffs were wire-rope manufacturers and contractors for aerial tramways and cableways. The defendants, who were also wire-rope manufacturers, published a trade catalogue, which contained two diagrams or pictures of aerial cable-ways, which had been designed and erected some years before by the plaintiffs' predecessors in title. The plaintiffs alleged that the publication of these diagrams by the defendants in their catalogue, was a representation that the same had been erected by the defendants. They claimed an injunction to restrain the further publication of the catalogue, and an order for the delivery of all the catalogues in existence. As a matter of fact, what the defendants had done was to supply new wire cables as they were required during several years. Mr. Justice Kekewich, in the course of his judgment, said: "No reasonable man, seeing these pictures in a book of this kind, would have any doubts that the defendants intended it to be understood that they had erected the tramway. It is as distinct a representation to that effect as if it had been expressed in plain language. . . . If it is proved to the satisfaction of the court in a case of this kind that the defendants did in truth say that the plaintiffs' goods were theirs, I think that, as between rivals in trade, the court would be justified in drawing the inference that the wide circulation of such a statement would necessarily damage the plaintiffs quite as much as in the ordinary case of the passing off of goods." These observations seem to show that if the plaintiffs had been able to prove that had they themselves erected the cable-way they would have had judgment; but the case was decided against them on another point. We may draw the following conclusions: That if Jones sells or advertises boots and shoes manufactured by himself in such a way as to make the public believe they are Brown's, and so obtain the benefit of Brown's good name, he may be restrained by injunction.

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FOREIGN PUBLICATIONS AND THE UNITED STATES COPYRIGHT LAW.—The Chicago Tribune, by agreement with the London Times, secured for use in the Tribune's columns the war news especially gathered by the Times, and its editorial comments thereon. The Times released its copyright of such articles as the Tribune's correspondent might choose to forward to his paper, the Tribune undertaking to copyright its daily edition simultaneously with the Times. On the other hand, the London correspondent of the Associated Press, buying the Times as it appeared upon the streets, selected such items as they wished and forwarded them to America. This news the Tribune strove to restrain the Associated Press from using, and asked damages in the sum of $100,000. The case (Tribune Company of Chicago vs. the Associated Press, 116 Fed. Rep., 126) was heard on bill and answer.

The questions raised are important and novel, involving on the one hand the rights of the Tribune Company to the fruits of its enterprise and expenditure under its contract arrangement with the Times, and on the other hand, the rights of the public to news published in the leading English newspaper. The solution of the problem depends upon the construction of the copyright statutes of the United States, and not upon the common law rights of literary property. Literary property is protected at common law to the extent only of possession and use of the manuscript and its first publication by the owner. With voluntary publication the exclusive right is determined at common law, and the statutory copyright is the sole dependence of the owner for a monopoly in the future publication. Unless the United States statute were applicable to protect the Tribune's publications in question, clearly the motion for an injunction would fail.

The copyright is obtained by depositing in the post office in Chicago on the evening before publication the general title of the newspaper, with serial number and date, and by like deposit, immediately after publication, of copies of the completed paper, addressed to the Librarian of Congress, and followed by registration and certificates in due course. No special matter is thereby indicated as subject to copyright, but the newspaper is entered as an entirety. It has been held in the United States courts that such a general copyright cannot with any propriety be applied to a work of so fluctuating and fugitive a form as a newspaper. Whatever this rule may be with reference to original matter published in a newspaper, it is certain there can be no general copyright of a newspaper composed in a large part of matter not entitled to protection.

Aside from this view affecting the validity of the copyright, on the showing that the defendant obtained its matter for publication directly from the London Times, and without knowledge or notice of any selection from the complainant, the statute, in the court's opinion, was not applicable unless through the contract rights of the Tribune, which operated to exclude from general publication all cablegrams and editorials appearing in the London Times. The contract gave to the Tribune the right to publish in America such cablegrams and editorials as it chose "to telegraph to America from the Times," and the Times abandoned in favor of the Tribune "any copyright in those telegrams so far as publication is America is concerned." The optional rights acquired by the Tribune extended to all cablegrams appearing in the Times, although the purported surrender for copyrights related to the extracts only. After the Tribune had both made and published its selections, no means were open to the public to ascertain the portion thus excluded from use. Many of the cablegrams in the Times, moreover, were not its exclusive property. Since the exclusive right of publication at common law terminated with the publication in London, the court held that no protection existed beyond that specially given by the statute. Before the amendment authorizing copyright in America on foreign publications under prescribed conditions where the publication is simultaneous, such foreign property right was left unprotected. Under the amendment general rights may be vested either in the Times or in the Tribune through contract, to copyright any editorials as special matter. The court was satisfied that the right could be exercised only for matter distinctly set aside for the purpose and so distinguished in the publication, and that publication in this country must be substantially identical with that in the foreign country to bring it within the intent of the statute.

This decision is of supreme importance to publishers, for it reiterates in decided terms the opinion formerly expressed in the United States courts that there can be no general copyright as an entirety of a daily newspaper which is composed in a large part of matter not entitled to protection.

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IMPROVEMENT AND INVENTION.—That all improvements are not necessarily inventions is clearly brought out in the case of Galvin vs. the City of Grand Rapids, recently decided in the Circuit Court of Appeals for the Sixth Circuit (115 Fed. Rep. 511) in favor of the defendant, who had won in the lower court. Judge Jay, in delivering the opinion of the court, stated that an improvement of a patent combination, which consists merely in carrying forward the old idea by a mechanical change in the form of one of the elements so as to produce a better result, but without changing the mode of operation, does not amount to patentable invention. The case under discussion involved the validity of the Lynch patent for a valve embodying an improvement on the valve of the Galvin patent. The Lynch patent was held void for lack of invention because it merely changed the form of certain wedges employed to close the disks. The improvement was one involving mechanical skill only.

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IT is said to Dr. Winkler, a lawyer of Lucerne, Switzerland, belongs the honor of having settled what is probably the longest lawsuit in the history of any country. Since 1370 a boundary dispute has been going on between Hungary and Galicia. The area in dispute is a tract of land about seventy miles south of Cracow, owned partly by Prince Hohenlohe, a German, and Count Zamoyski, an exiled Polish noble from Posen. This dispute of 500 years duration has led to much bitter feeling in the neighborhood, as both Hungarians and Poles have hotly contested the question and loudly asserted their claims. The arbitrator has decided in favor of the Galician claim, and allows Hungary only twenty acres to straighten her boundary.

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LIMITATION OF THE SUBJECT OF DESIGN PATENTS.—The well-known rule that a design patent cannot be sustained on the ground that the article has mechanical utility, but that to be valid it must relate to a matter of ornament and have an æsthetic value, was once more enunciated in the case of Eaton vs. Lewis (115 Fed. Rep. 635). In accordance with this principle it was held that a fastening for machinery belts is not an appropriate subject for a design patent.

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ANTICIPATION.—The Davidsen patent for improvements in tubular ball mills for pulverization of various materials was rejected seven times on references to prior patents, notably the British patent to Redfern, and was finally granted on an amendment to the claim with expressed reluctance. The United States Circuit Court of Appeals has just declared it void for anticipation and dismissed a bill filed to restrain an infringement.

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## RECENTLY PATENTED INVENTIONS.

### Engineering Improvements.

ROTARY ENGINE.—C. E. SHUMWAY, Albion, Mich. Mr. Shumway is the inventor of improvements in rotary engines operated by steam pressure. Certain novel details are provided in this engine whereby the construction of the same is simplified. The parts are so arranged as not to be liable to get out of order.

FLUID-PRESSURE BRAKE.—T. J. LEARD, Chanute, Kans. The invention relates to fluid pressure brakes on a train having two or more engineers. Certain improvements are provided whereby the engineer of the first or leading engine has complete control of the entire brake mechanism of the train, and by the air brakes and main reservoirs and pumps of both engines are used to furnish the compressed air for the auxiliary reservoirs. The parts are controlled without requiring any attention on the part of the engineer of the second engine.

BOILER-PIPE CLEANER.—J. H. WILLIAMS, Wilson, Kans. In steam boilers the water pipe that connects the water space of the boiler with the lower part of the water column and water gage, is very liable to become choked with sediment and scale, because the water in this pipe is free from violent ebullition. When so choked up it is liable to make the water level in the glass different from that in the boiler, and by so falsely indicating the amount of water in the boiler, might lead to a disastrous explosion. The object of this invention is to provide means for overcoming this difficulty.

### Hardware.

SAW-SET.—O. R. JOHNSON, Escanaba, Mich. An improvement in saw-sets is provided by this invention which consists of a convenient hand tool by means of which, in one operation two teeth may be set in opposite directions, thus reducing the length of time required for setting the saw and assuring a uniform set. The device can be quickly adjusted to saws of different sizes.

FENCE-WIRE FASTENER.—G. H. WRIGHT, Spokane, Wash. The fastener provided in this invention has a peculiar construction, especially adapted for uniting crossing wires in wire fences. The device is adapted to co-operate with the bends of the wires at the point of intersection to hold the wires in proper position, and in such manner that the clamp or fastener will be retained against any tendency to displacement.

NUT-LOCK.—B. R. SWORDS, Ottawa, Ill. The object of the invention is to provide an improved nut-lock designed for use on bolts for rails, fishplates, locks and other parts of machines and devices. The nut-lock is simple and durable in construction, and is arranged to permit of screwing up the nut to the desired degree and then securing it against accidental unscrewing.

OYSTER-TONGS.—C. K. and W. T. SHAW, Bellport, N. Y. These inventors provided improved oyster tongs which are arranged for loosening, gathering, and securely holding the oysters without requiring undue physical exertion on the part of the operator when dredging for the oysters. The construction permits convenient and quick repair of any of the parts.

CAN-OPENER.—H. SIDMAN, Pomona, N. Y. An improved device is herein provided for cutting the ends from metal cans. The device has a simple construction by means of which the ends or top of the can may be quickly cut out and the edge of the metal turned or crimped to form a smooth surface not liable to scratch a person's fingers.

### Mechanical Devices.

PEARL-BUTTON-TURNING MACHINE.—J. LOOG, Brooklyn, N. Y. Mr. Loog is the inventor of a machine for turning pearl buttons which is arranged to permit of turning the face of a button the desired depth, according to the thickness of the stock to be treated, and without removing the tool from the tool-rest.

WASHING-MACHINE.—H. J. LOCKHART, Fostoria, Ohio. An improvement in washing machines is provided by this invention. The articles to be washed are drawn between revolving rollers, one of which rollers has also a longitudinal reciprocating movement to accomplish the necessary rubbing of the goods. The invention provides improvements on a machine of this class whereby the results above specified are accomplished in a more efficient manner.

HEMMING ATTACHMENT FOR SEWING MACHINES.—THOMAS F. DENNISON, 251 Marcy Avenue, Brooklyn, N. Y. Mr. Dennison is the inventor of an improved attachment for sewing machines adapted for making a hem on linen, silk or cotton goods, handkerchiefs, garments, and the like. Means are provided for adjusting the device so that the hem may be of different widths, ranging from about an eighth of an inch upward. The construction of the scroll is such that it may be readily and quickly adjusted to goods of different thicknesses. The attachment is very simple and of a convenient size to operate and to apply to a machine.

LINOTYPE-LEADER.—B. COLE and A. O. WILSON, Lincoln, Neb. This invention forms no part of a machine for producing linotypes. It is a separate and distinct machine adapted to support stored slugs and leads in separate quantities with mechanism operated to feed first one, then the other to a common galley or hopper in interlaid position.

### Railway Improvements.

ATTACHMENT FOR RAILWAY WATER-TANKS.—R. T. CUMMINGS and W. W. WYKOFF, Maysville, Ky. Water tanks for supplying water to locomotive tenders are usually provided with a delivery pipe which is attached and hinged in such manner as to be adapted to swing in a vertical plane, but not for movement parallel to the track. Consequently the locomotive must be stopped on the track in such position that the inlet opening of the tender will be exactly opposite this delivery pipe. This is often a matter of considerable difficulty, and in order to avoid this objection Messrs. Cummings and Wykoff have invented an apparatus so constructed as to allow considerable range of movement of the delivery pipe parallel to the pipe.

SWITCH.—A. E. JAMES, Natchez, Miss. In this invention Mr. James provides a novel construction whereby the switch tongue will be held normally in one position by means of a spring, so it can yield from such position to permit the cars to pass in one direction. The switch tongue is thus made automatic and delay incident to the operation of the switch point by the motorman is thus avoided.

### Vehicles and Their Accessories.

COMBINED HUB SPINDLE AND THIMBLE.—S. GREGORY, Trinidad, Colo. The purpose of this invention is to provide a combination of hub spindle and thimble which will insure a hub remaining and properly turning upon the spindle in the presence of a lubricant until purposely removed, and which will prevent undue lateral movement of the hub or undue wear and tear upon the spindle and hub-thimble.

SECURING-ROD FOR END-GATES.—H. M. MCGREW, Pickrell, Neb. Means are provided in this invention for detachably securing in place the rear end gate of a wagon body. The invention comprises certain novel details of construction for a securing rod that adapt it for every convenient application and removal and afford means for adjusting the length of the rod to conform with the width of the wagon body it is applied upon.

WAGON-BODY LIFTER.—C. W. NABB, Charleston, Mo. Mr. Nabb herein provides an improvement in wagon-body lifters. The novel construction employed is adapted to lift the wagon body and subsequently to lift the running gear. The several devices provided are in such form and arrangement that almost all of them can be made by a farmer from the timber at hand, thus avoiding the expense and inconvenience of securing the best timber.

### Miscellaneous.

HOLDER FOR PEGS FOR STRINGED MUSICAL INSTRUMENTS.—S. A. GREGG, Sedalia, Mo. This invention relates to improvements in devices for holding and regulating the friction of pegs for musical instruments, such, for instance, as violins, cellos and the like. The holding device may be readily attached to a peg and will not scratch or mar the varnish on the peg box. The device is adapted to firmly hold the pegs from turning or slipping under the strain of the strings.

BOX.—H. L. AVERILL, Piermont, N. H. This improved box is adapted to receive and protect butter especially during transportation. The box has an economic form made in hinged sections, which when open will expose the top and a portion of the sides of the contents of the box, enabling the contents to be inspected. Means are provided on the box by which the butter may be cut, and a handle is employed which serves as a lock for the box when closed.

BROODER.—M. J. MAPES, Springvalley, N. Y. The invention provides an apparatus for sheltering young chickens, particularly those which have been hatched by means of incubators. The construction embodies various novel features by which the brooder may be more effectively and uniformly heated without in any way interfering with its proper ventilation.

HAY-CAP.—G. W. SIMONS, Posey, Ill. Mr. Simons' invention consists in peculiar fastening means whereby a series of boards may be secured together in a way especially adapted to form hay-caps, as also roof and other coverings. In carrying out the invention Mr. Simons employs a series of boards of desired length and thickness, and arranges them with lapping edges adapted to be screwed by fastening links.

DIVING APPARATUS.—E. B. PETRIE, New York, N. Y. The diving apparatus which is provided in this invention is adapted for deep-sea diving, withstanding the pressure of deep water without detracting from the comparative comfort of the diver. The invention also provides perfectly articulating water and air tight joints at the connections of the hip, body, and leg sections, and the knee, ankle and elbow sections. Thus affording the diver in a heavy suit the greatest freedom of action.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

**Inquiry No. 3347.**—For makers of the Gravity coal oil burner.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

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MANUFACTURERS! Want any parts made of any metal? Write us. Metal Stamping Company, Niagara Falls, N. Y.

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**Inquiry No. 3350.**—For manufacturers of adding and listing machines.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

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**Inquiry No. 3355.**—For machines for manufacturing articles from the hull of the cocoanut.

We manufacture on contract: patented hardware specialties, tools, dies, metal stampings, special machinery, etc. Edmonds-Metzel Mfg. Co., 778 West Lake Street, Chicago.

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A qualified person desires position as assistant superintendent in machine shop in north or east. For particulars address R. Kreiter, care of Dickson Car Wheel Co., Houston, Tex.

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WANTED.—First-class machinery draughtsman. One with gas engine experience preferred. Address giving references, to Holland Torpedo Boat Company, New Suffolk, Long Island, N. Y.

**Inquiry No. 3358.**—For dealers in electro-plating apparatus in Chicago or St. Louis.

Gasoline Automobile Batteries. William Roche's "Autogas" used properly will carry vehicle twice as far as any other battery of same weight. William Roche, inventor and manufacturer, 42 Vesey Street, New York, N. Y., U. S. A.

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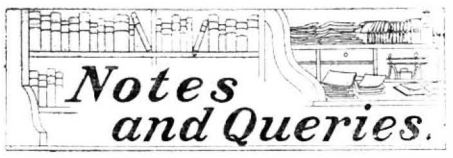
**Inquiry No. 3365.**—For makers of oil burners for engines.




### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
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(8733) W. D. S. says: In your "Scientific American Cyclopedia," under the head of "Soaps," is a formula for making "Yellow Soap," the last of the list of soaps. It gives: Tallow, ½ lb.; sal soda, 1½ lb.; resin, 5-6 lbs.; stone lime, 28 lbs.; palm oil, 8 oz.; soft water, 28 gal. Surely this is a misprint. Will you kindly give me the correct formula, as I wish to make a soap with sal soda and lime. Also, could you give me the formula for making bisulphide of carbon for killing gophers and weevil? A. For the manufacture of ordinary yellow soaps, the fats used are tallow, palm oil and resin. These may be used in such varying proportions that a few general facts will be of more value than one specific formula. Fats require from 13½ to 15 per cent of caustic soda for complete saponification. Rosin also requires about 15 per cent. As caustic soda is more expensive than soda ash (carbonate of soda), it is common practice to take soda ash and causticize with lime. An excess of lime is usually used. 100 parts of soda ash are dissolved and heated to boiling; 75 to 100 parts of lime are then added, and the boiling continued for about one-half hour. It is then allowed to settle, and the clear solution is used for making the soap. In estimating the amount of soda ash required, it may be assumed that 100 parts of soda ash are equivalent to 75 parts of caustic soda. The proportion of rosin used is extremely variable; in some cases, equal amounts of fat and rosin are taken, but this is considered excessive. For a good laundry soap the amount of rosin may vary from 25 per cent to 40 per cent of the fat taken. Carbon bisulphide is now largely being made in the electric furnace. It could not be manufactured on a small scale. It can be purchased in any quantities at reasonable price.

(8734) A. B. S. says: I am using large quantities of soft zinc from which I make small stampings, leaving about 30 per cent that I am obliged to put into scrap. This scrap is worth to me 4 cents a pound, whereas the new material costs me 12 cents. My idea would be to melt down this scrap that I have and reroll, but in trying this I find that the metal becomes so hard that it breaks in rolling. I presume that during the process of melting one or more of the component parts passes off in the form of a gas, or perhaps my appliance for melting is not what it should be. I am familiar with the melting of copper and with the various alloys of brass, but this matter of remelting zinc and putting it in shape to stamp properly is something I am unfamiliar with. A. Melt the zinc at the least possible temperature, and pour into heated iron moulds so that the cooling shall proceed very slowly. Avoid introducing any iron accidentally into the zinc during the melting, as iron causes brittleness. Adding 0.5 per cent lead makes the zinc more malleable. It should be rolled out at a temperature of 150 deg. C. to 200 deg. C., at which zinc is most malleable: at temperatures much above or below these limits, the zinc becomes too brittle to roll.

(8735) D. J. B. wishes to know what the back pressure per square inch would be in the cylinder of an engine operated by compressed air instead of steam, and where the air is allowed to expand fully in the cylinder before the exhaust valve opens. A. The back pressure at the exhaust of an air motor depends entirely upon the cut-off point and the initial pressure as with steam in principle, but does not follow the same ratio. See Hiscox's book on "Compressed Air."

(8736) F. M. wishes to know the best chemical used to purify acetylene gas. A. First wash with water to remove ammonia. To remove the other impurities, chiefly compounds of phosphorus and of sulphur, the following chemicals have been used: 1. Chloride of lime: unless all ammonia has been removed, nitrogen chloride may form. 2. Solution of cuprous chloride: one liter of this solution will purify 14 to 16 cubic meters of gas. 3. Solution of chromic acid in sulphuric acid: 5½ grammes of chromic acid will purify 1 cubic meter of gas. 4. Paraffin oil or other hydrocarbon oils. Solutions 2 and 3 give the best results. 4. used in conjunction with 2 or 3, increases the certainty of the purification.

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(8737) C. F. H. asks: Can you give me any information as to the mixture used in binding coal screenings together that are made into briquettes? A. The best material for binding coal fines into briquettes, and the one most largely used, is pitch. Asphalt has had a limited use. Starch paste, residues from starch manufacture, dextrine, molasses, etc., have been used from time to time experimentally, but are not practicable. Various mineral substances, such as clays, lime, water-glass, etc., have also been proposed, but naturally have the drawback of adding just so much ash. Occasionally, oxidizing materials, such as niter, are added, when it is desired to produce a very quickly burning briquette for the rapid generation of high temperatures.

(8738) W. J. C. wishes to know how to remove indelible ink marking from clothing. A. Indelible inks are of such variable character that it is quite impossible to reply. Many of these inks have nitrate of silver as a basis; in this case, a solution of hyposulphite of soda might help. Some other inks might possibly be bleached out with javelle water and weak muriatic acid; this can be used only on white goods, as most dyes would be destroyed. Possibly also a solution of sulphurous acid might be of service.

(8739) S. R. asks for a good receipt for making a reliable fire extinguisher in powder form, one that is easy to prepare. A. For a cheap, dry powder fire extinguisher, bicarbonate of soda will serve; it may advantageously be mixed with 5 per cent to 10 per cent in some powdered mineral, as flint, tripoli, chalk, etc., to prevent caking in damp air. A mixture of *dry* bicarbonate of soda with *dry* sal-ammoniac, and kept in a *dry* place, will do better, as it would yield both carbonic acid and ammonia. In a confined space fire extinguishers of a type similar to gunpowder have proved effective; the object being to fill the room with carbon dioxide, sulphur dioxide and nitrogen gases and thus choke the fire. A good formula for this type of extinguisher is niter, 60 parts; sulphur, 36 parts, charcoal, 4 parts.

(8740) W. R. asks what the different gases are which, if introduced into an inclosed arc lamp will turn the color red, green, yellow, blue, etc. A. Colored electric lights are ordinarily produced by coating the globe with an aniline dye, made in alcoholic solution, and mixed with a little varnish. We do not know any gas which could withstand the heat of the arc for any time and which could color the arc. Some color can be imparted to the arc by soaking the carbons in solutions of sodium chloride, strontium chloride, or lithium chloride, and drying them thoroughly before using. The light of the arc itself is so intense that it is very difficult to overcome it with any other colored light.

(8741) H. M. asks: Can you give me information as to what a transformer is and what it is used for? I have been informed that it is much on the scale of an induction coil. If so, can you give me some scale by which to transform a 110-volt current into amperes? A. A transformer changes an alternating current from one voltage to another and from one current strength to another. It cannot change volts into amperes. In that respect they resemble induction coils. An induction coil is a particular sort of transformer, provided with a condenser, interrupter, etc. It is used almost entirely for raising the voltage. You will find a good chapter upon Transformers in Houston and Kennelly's "Alternating Currents." 2. Also please tell me how many volts it will take to each ampere, and a scale of how it should be wound, what size wire to use, and if the fine wire should be used outside or in? A. It is impossible to change amperes into volts. And as to the winding, each one is wound for the work it is to do. There is no general winding.

(8742) G. W. L. asks: 1. What is the most economical method of generating carbonic acid gas—not necessarily pure—in large quantities? A. The commercial sources of carbonic acid, on a manufacturing scale, are as follows. 1. By the burning of limestone. 2. By the action of acids in limestone (calcium carbonate), magnesite (magnesium carbonate) or dolomite (calcium magnesium carbonate). The acid used is sulphuric. This method is used by the manufacturers of bottled effervescing waters. 3. By collecting the carbonic acid gas generated in the fermentation vats of large breweries. This source is largely used in Germany. In addition, the gas coming from many of the natural springs is collected. This practice is also largely used in Germany. 2. Are there any known chemicals, or other substances, that will decompose water, aside from the alkaline metals? A. Besides the alkaline metals, water is decomposed by many of the hydrides and carbides of the different metals. Thus calcium carbides decompose water with the formation of lime and acetylene. Also, vapor of water passed through red-hot tubes of different metals is decomposed into its constituents. Vapor of water passed through red-hot coal is decomposed, with formation of carbon monoxide and dioxide, hydrogen, marsh gas ($CH_4$) and other hydrocarbons; this is the basis of the industrial manufacture of water gas, which has displaced coal gas in most cities.

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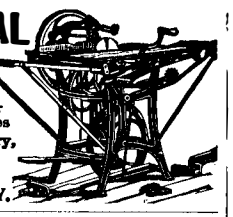

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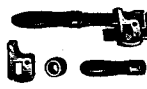

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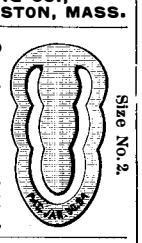

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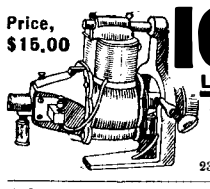

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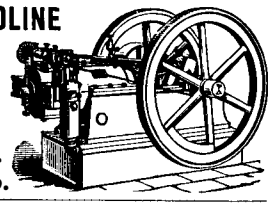

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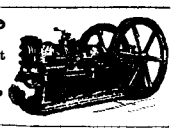

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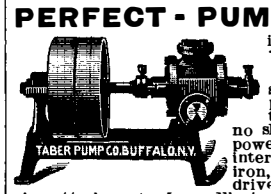


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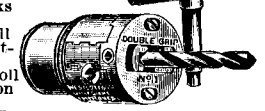

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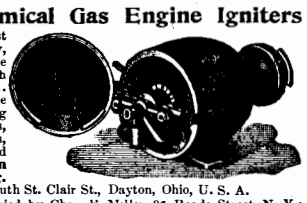

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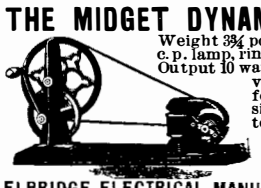

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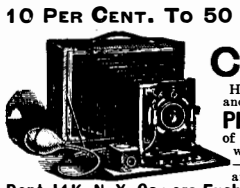

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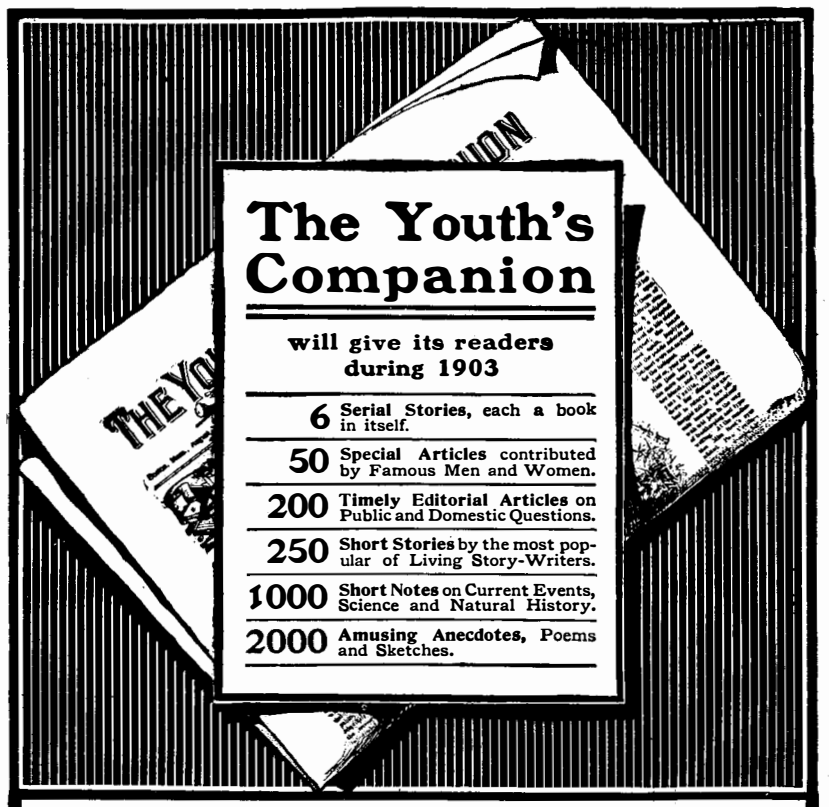

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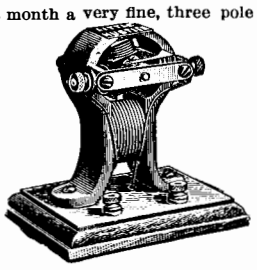

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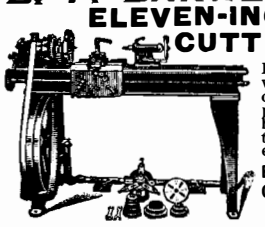

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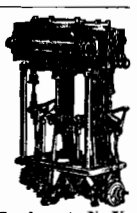

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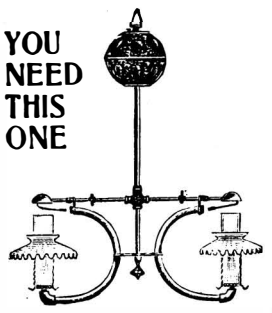

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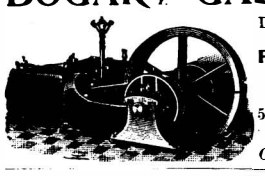

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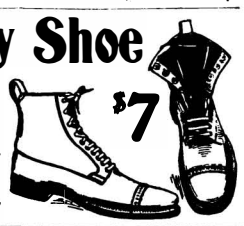

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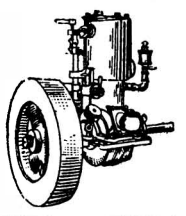

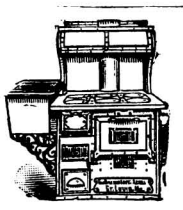

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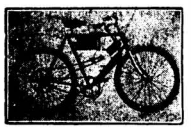

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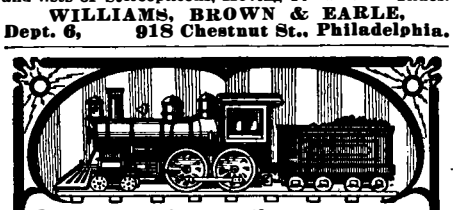

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The scope of the work in design ranges from the simpler composition problems of the second year—among which we notice "An Entrance to a Small Public Library," a "Mausoleum for a Country Estate," a "Restaurant for a Fashionable Watering Place"—to the severer tasks imposed in the fourth and graduate years. Of the former, "A Nautical Amphitheater," "A Presidential Mansion," "A Municipal Hospital for the Insane," sufficiently indicate the interests considered. The work of the graduate year is more mature, and indicates extended tests of the student's powers of composition as well as his discrimination in handling the practical details of competition work of the highest class. Mr. Thornton Oakley's "Study for a University Group," and Mr. Julian Abele's "Metropolitan Cathedral," are typical examples of this and reflect the highest credit on both instructor and pupil.

THE AMERICAN TRANSITION. (Via the Buckler and Boss.) From a Republic to a Theocracy. Copyrighed 1902 by the Equinoctial Press, State of New York. 1902. Pp. 118.

STATISTICS OF MANUFACTURES. Comparisons: 1895, 1900. By Horace G. Wadlin. Boston. 1902. Pp. 39.

TWENTY-FIFTH ANNIVERSARY OF THE COMPOUND LOCOMOTIVE, 1877-1902. Paris. Pp. 4.

NATURAL PHILOSOPHY. A System of Our Knowledge of Nature. With an Attempt to Explain the Mysteries. By James Ferguson. New Edition. Complete in one volume. New York: The Alliance Publishing Co. 1902. Pp. 112.

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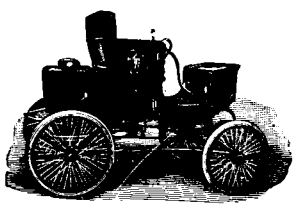

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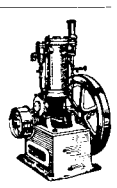

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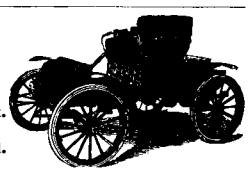

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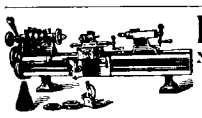

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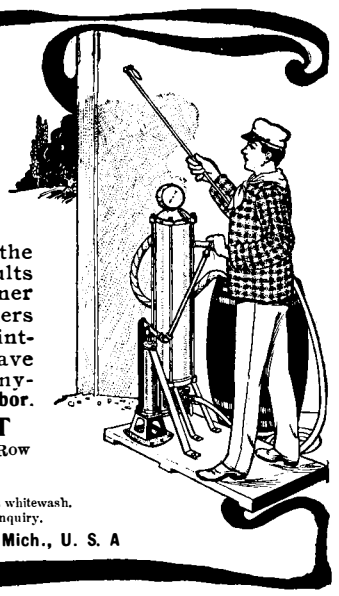

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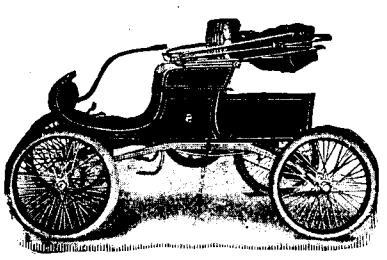

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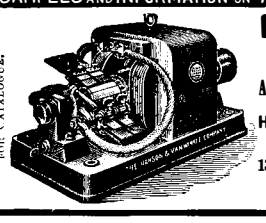

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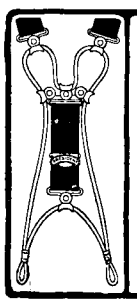

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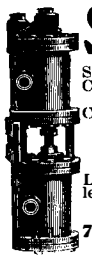

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